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Editor:
NEVILLE WILLIAMS, M.I.R.E.E. (Aust.) (VK2XV).

sistant Editor:
PHILIP WATSON, A.M.I.R.E.E. (Aust.) (VK2ZPW).

:hnical Editor:
JAMIESON ROWE, B.Sc. (Tech.), Grad. I.R.E.E. (Aust.).

:hnical Staff:
IAN POGSON (VK2AZN).
KEITH WOODWARD (VK2ZAU).
HARRY TYRER.
MICHAEL MEECHAN (VK2UF).
ROBERT FLYNN.

torial Offices:
12th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext. 2531, 2525-6-7.

tal Address:
Box 2728, G.P.O., Sydney, Australia.

vertising:
SELWYN SAYERS, Mgr.
BILL SUMMONS, Rep. Sydney.
CLARRIE LEVY, Rep. Melbourne.
Offices: 8th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext. 2931, 2508, 2943.

:ulation:
W. CUMMINGS, Mgr.
Offices: 9th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext. 2505, 2509.

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VER PICTURE

Modern electronic technology is calling for an increasing amount of gold plating because of its chemical stability and excellent electrical properties. Pictured are several gold-plated printed wiring boards. The Betascope, also pictured, allows the thickness of the plating to be determined quickly and non-destructively, ensuring that the plating is thick enough to give protection but not so thick as to waste precious metal. (See page 4).

STEREO BROADCASTING

SOME months ago, the Australian Broadcasting Commission revised their program schedules. In the course of so doing, they deleted the twice-weekly stereo broadcasts, which had been provided, in certain centres, by pairing transmitters from the separate networks.

In the October issue, we published, in precis form, a letter of protest over the initials B.C. of Hornsby, N.S.W. One of the sentences omitted from our condensed version was the first which began "I have no doubt that you have already moved in this matter . . ."

Following publication of this letter, a few readers commented on B.C.'s general attitude to radio, tape and disc as program sources, but only one solitary letter has come to hand supporting the original cause.

Here then is the picture: "ELECTRONICS Australia" has a paid circulation of over 45,000 copies per month and can quite reasonably claim a regular readership of at least 150,000. A very large proportion of this readership is interested in high fidelity sound reproduction and yet, when the A.B.C. terminated stereo broadcasting, exactly two people bothered to write to us about it! Even the A.B.C., I understand, received very few protests, typically less than a dozen for the whole of New South Wales.

These facts demand comment.

They could mean that hi-fi enthusiasts have turned en masse to disc and tape for their listening pleasure, with radio filling little more that a casual or "service" role. This was more or less what I suggested in the October issue, when commenting on B.C.'s letter.

If it is not so, and people really do take radio seriously as a source of hi-fi listening pleasure, then they must surely be the most un-vocal group that ever existed. No wonder the A.B.C. concluded that stereo broadcasting had very little appeal! Perhaps lack of expression was a reason for the managers of so many independent broadcasting stations deciding that the only people who really matter are the teenagers who, with their horrible little transistor sets, leave no doubt about the fact that they listen.

If the serious music audience exists, and wants to be better served, it is quite essential that it make its presence felt. It might even help convince the people who matter that there is a case for high fidelity FM-stereo broadcasting. Otherwise—and I am very serious about this—the next big event in Australian electronics will be colour television.

N. G. Williams

January, 1966

How Thick Is Thin? 4
Window On The Invisible 9
Prospecting With Isotopes 11
Planned Music for Industry .. 12
Review—Translator Stations .. 17
Review—Protecting Detonators 19
Scientific and Industrial News 21
Radio Control for Modellers .. 28
Observations on Deltahet 35
"Vari-watt" Power Controller 41
Log Periodic Dipole Antennas .. 50
Australian Radio, TV Stations 56
N.Z. Radio, TV Stations 59
Answer Man 63
Serviceman 67
Audio Topics 71
Classical Reviews 75
Documentary Records 79
Variety Fare 81
Trade Reviews and Releases .. 89
Amateur Band News, Notes .. 92
Listening Around the World .. 101
Answers to Correspondents .. 105
Books and Publications 109
Classified Advertisements 111
Index to Advertisers 112
Classified Ad. Form 112
Subscription Form 112

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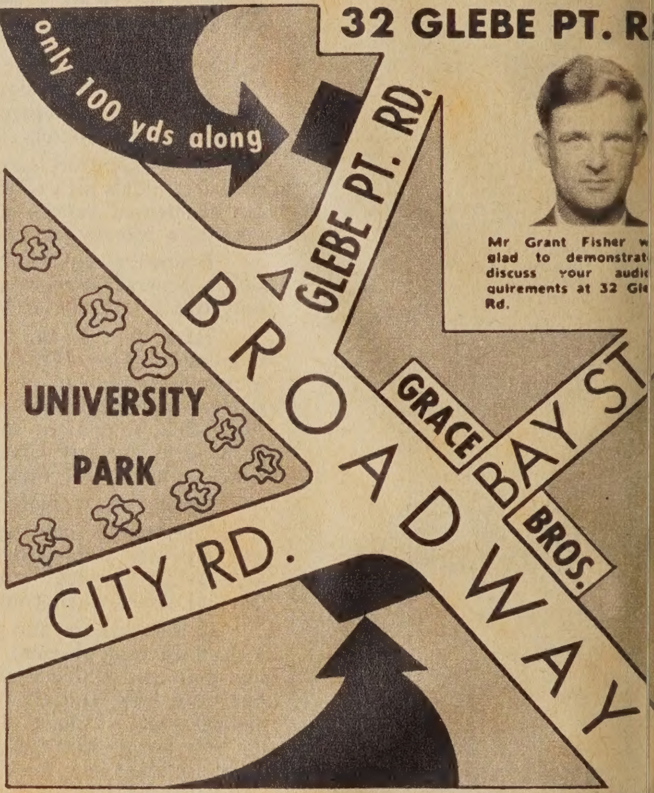

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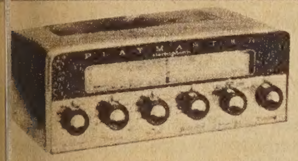

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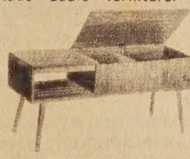

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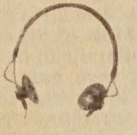

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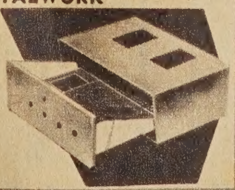

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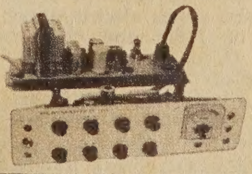

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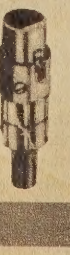


We are distributors for the well known Cannon audio connectors. All types available ex-stock including 3, 4, 6 and 7 pin types. Price list available.

BUT HOW

The process of electro-plating consists, basically, of depositing a thin film of a selected metal over th surface of the article being plated. Since the early days of electroplatir, the purchasers of plated objects have asked the question, "How thic is the plating?" This brings us to the question posed by the heading!

By Robert G. Stone*

Up till a few years ago, plating with precious metals was an activity identified mainly with the jewellery trade, and aimed at achieving an appearance and tarnish resistance appropriate to the particular item.

For the most part, the techniques employed were traditional. Most of the formulations in the gold-plating field, handed down over the years, were based on the use of cyanide and low metal concentrations at elevated operating temperatures, often quite near boiling point.

Recently, however, the space program and a variety of other comparable activities have discovered a vast new field for precious metal plating in the closely allied space and electronics industries. Gold and rhodium are making inroads on finance budgets to a degree that would have appeared ludicrous 10 years ago. What is more, techniques and activities which were unheard of, even five years ago, are now matters of routine.

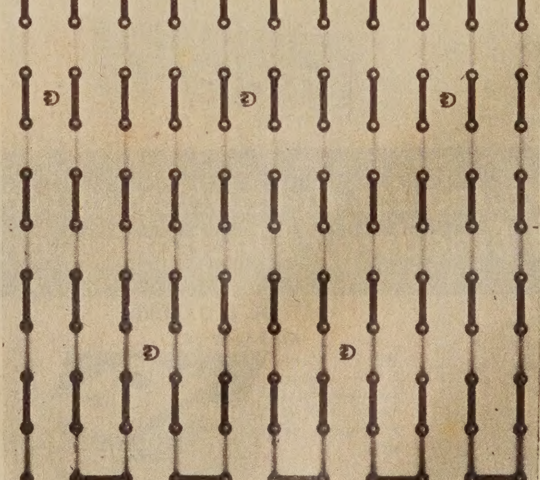
Who would have dreamed, for example, of electroforms, ¼in thick and weighing 100oz, in gold with a purity rating of 99.99 per cent? Or of rhodium and platinum pieces electro-formed to a thickness of 1/8in and compressively stressed? Or of gold-plating the entire nose cone of "Discoverer" space capsules with a layer 100 micro-inches thick, to reflect infra-red and minimise heat during re-entry?

Upsetting an established tradition, the electronics industry is now tending to reject silver-plating for critical applications, because of its disturbing tendency to grow minute "whiskers." Gold-plating is being specified instead.

Over and above normal conductors, connectors and component surfaces, gold-plating is being used freely for the better class of printed wiring board, in association with board materials which are themselves quite expensive.

Significantly, however, the kind of gold or other precious metal-plating which is being demanded by the space-age electronic industry, is far removed from the traditional methods mentioned earlier.

The old hot cyanide system is basically unsatisfactory, producing a coating with questionable adhesion, co-deposition of unwanted material, with voids, poor grain orientation and deposits which are generally spongy, rough and porous. The hardness of the surface seldom exceeds 65 on the diamond pyramid scale, and the coating is often found to deteriorate rapidly during even moderate environmental testing.



Produced to illust te modern techniq s, this board has a se s of "printed" meta ic strips on each s e, which have been joi d into one continu s conductor by pla g through the holes n the board, the en re metallic surface b g finally gold-pla d. The through-hole p t- ing technique obvi s the need for eye ts and eliminates a p- ential source of y joints. Adhesion of l- der to conductor d conductor to board is extremely high.

While traditional methods are still employed to some extent — because they are traditional or because the plant is on hand—progressive electroplaters are coming more and more to favour modern formulations. These can be identified with men like Rinker, in the early 1950s, and Duva in the early 1960s, who showed the way to high orders of purity, to better grain structure, thicker coatings, better surface finish, new co-deposition techniques, closer control and such ke

This knowledge has allowed ele ro platers to meet the special requiren nts of the electronics industry and also, s a matter of interest, to offer better at- ing to the jewellery trade. But the ec- tronics industry is especially interest in such qualities as:

SOLDERABILITY: This has t do with the ability of the surface to "t ke" solder, whether the surface happe to be newly plated or otherwise. Over nd above this is the strength of the bo a the interfaces, namely solder-pl ng plating-plating or plating-substrate.

HARDNESS: Very important for on- nectors or where there is any chan of abrasion. Brittleness must be avo ed, however. Hardness can be achieve by co-depositing suitable and less r ble metals, which also tend to improve ain structure and brightness. Typical a co-deposit of 99.5 per cent gold nd

---

* *Stone Bros., Electroplaters, 5-59 Beans Rd., Thebarton, S.A. Base on an address to the Australian Co as- ion Society, Adelaide, and an a cle in "The Journal Of Industry," an- uary, 1965.*

THICK IS THIN?

5 per cent cobalt gives high wear re- stance, freedom from brittleness and igh solderability, being well suited for rinted wiring boards and connectors.

PURITY, or the freedom from inci- ental contaminants. It is a familiar ord, nowadays, in the electronics in- ustry and figures of not less than 99 er cent and up to 99.9 per cent appear n M.I.L. specifications.

THICKNESS of coating, provided it shown to be adequate and uniform, rovides the guarantee that the substrate ill be adequately protected.

Because environmental conditions are requently so onerous, and yet because ost is such a vital factor, the old ques- on of how thick the plating should be ssumes a special significance. Plating hich is too thin overall or in certain reas will fail to give the required pro- ction; plating which is unnecessarily ick contributes nothing to the requir- d result, but adds markedly to the cost.

There are several methods of measur- ng thin films of precious metal deposi- ed over common subtrates, the one most sed up until now and still regarded as e reference guide, is by micro section. small sample is cut from the surface eing measured, mounted and polished, e film then being measured with a filar icroscope. This happens to be a tedious nd exacting job, reliable results being btained only by a highly skilled per- on. It is very time-consuming — per- aps only one sample for a day's work.

For these who have no background in e subject, an excellent summary of lating evaluation methods through the ears appears in "Metal Finishing" for ecember, 1963, by Joffe and Modjeska. o quote:

"Certain immersion tests for various ase metal deposits were used, more or ss rule-of-thumb techniques: Tests as rude as pencil eraser-abrasion resistance omparisons were employed for use on oft' deposits.

"During World War I the Preece Test as developed for zinc coatings, and, uring the 1920s hydrochloric acid- ntimony chloride was used to measure rip-time for cadmium; also the sulphide yer test for this metal. Then, during e 1930s, came drop tests for cadmium nd zinc, Clark's jet tests for nickel, opper, silver, etc., and the hydro- hloric acid spot test for chromium.

"In 1934 the 'plater's microscope' was ntroduced, and strip and weigh tech- iques in various forms were employed idely. Still destructive, but with less hance for human (variance) error, were he anodic spot-stripping techniques of oward Francis.

"Aside from the varying time require- nents and the skills necessary, all the foremented tests are destructive. ust as much so, as the ignition test for iamond purity — 'if, when burned, a iamond left zero ash, it was a perfect em' — a perfect test for a perfect fool."

Appropriately, the electronics industry hich is now making such demands pon electroplaters, came to the rescue. Several years ago an instrument was offered for sale that could measure films rom a fraction of a micro-inch to several thousands by a radically new method developed by the Boeing Company in U.S.A. Since then at least three other companies — two in U.S.A. and one in Germany — have produced instruments based on this development, and made them available to the crying needs of industry. One such machine, as pictured opposite, is now installed in an Adelaide laboratory and is being used for measuring the thickness of gold-plating on printed wiring boards.

One of the main features of this new method of measurement is that it is non-destructive; the measurements can be done without causing any damage to the surface concerned and the time taken need not exceed a minute or so for each determination. The repeatable accuracy is within 1 per cent, provided certain laws are obeyed.

The principle of operation is as follows: If a beta-emitting radioisotope is directed at the surface of an object, some of the energy is absorbed and passed through, whilst a proportion is reflected, or back-scattered. This back-scatter is a function of the atomic number of the substance being tested and by utilising a counting device the number of beta particles being back-scattered can be accurately measured.

When dealing with a plated surface, it is possible to have the energy particles penetrate the surface coating and be variously reflected or absorbed by the substrate. By comparing the results with those from an unplated specimen of the same substrate, the modifying effect of the coating on the energy can be deduced and interpreted as a function of coating thickness.

The depth of penetration most appropriate to the surface to be measured can be controlled by the choice of the emitting isotope, as follows:

MOST COMMON BETA EMITTERS

Radio-active Substance	E. Max M.E.V.	Half Life in years
Carbon 14	0.16	5,570
Cesium 137	0.51	30
Strontium 90	2.18	28
Rhodium 106	3.53	1

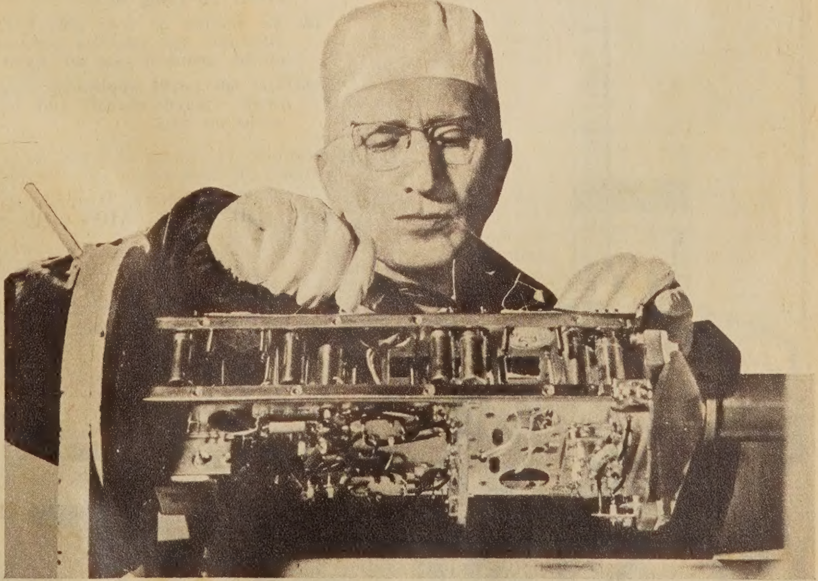
Take the instance of determining gold over copper, as in the case of a printed circuit. Expecting the gold to have a thickness of about 100 micro inches, the area to be measured is placed over the platten surrounding the isotope; the beta rays are then reflected and sampled by a Geiger Mueller tube, which then feeds the signal to a scaler with an electronic timer and the read-out shown on neon read-out tubes over a time of say 15 seconds.

For this thickness a Cesium isotope would be recommended, because its range is from 35-300 micro-inches.

A count is then done on a piece of copper laminate, and this figure subtracted from the count of plated sections. This is the figure corresponding to the gold thickness, and from a previously calibrated graph, using known standards, it is very simple to observe the thickness.

For very precise measurements an extended counting time up to four minutes can be made, but using the above instance of gold over copper an accuracy of two or three millionths of an inch is easy with only a 15-second count.

The accuracy falls off, however, as the atomic numbers approach one another. Copper and nickel cannot therefore be separated, because with nickel at Z equals 28 and copper Z equals 29, the counting time would have to be almost infinity.



Modern, precious-metal plating techniques are vital to the success of space vehicles, with their severe environmental problems. But gold plating equally finds application in these cable repeaters manufactured by S.T.C., London, which are expected to give trouble-free operation for at least twenty years, lying on the bed of the ocean. Apart from the fact that gold plating minimises surface deterioration, it does not exhibit the same tendency as silver to grow "whiskers" which can ultimately cause electrical breakdown.

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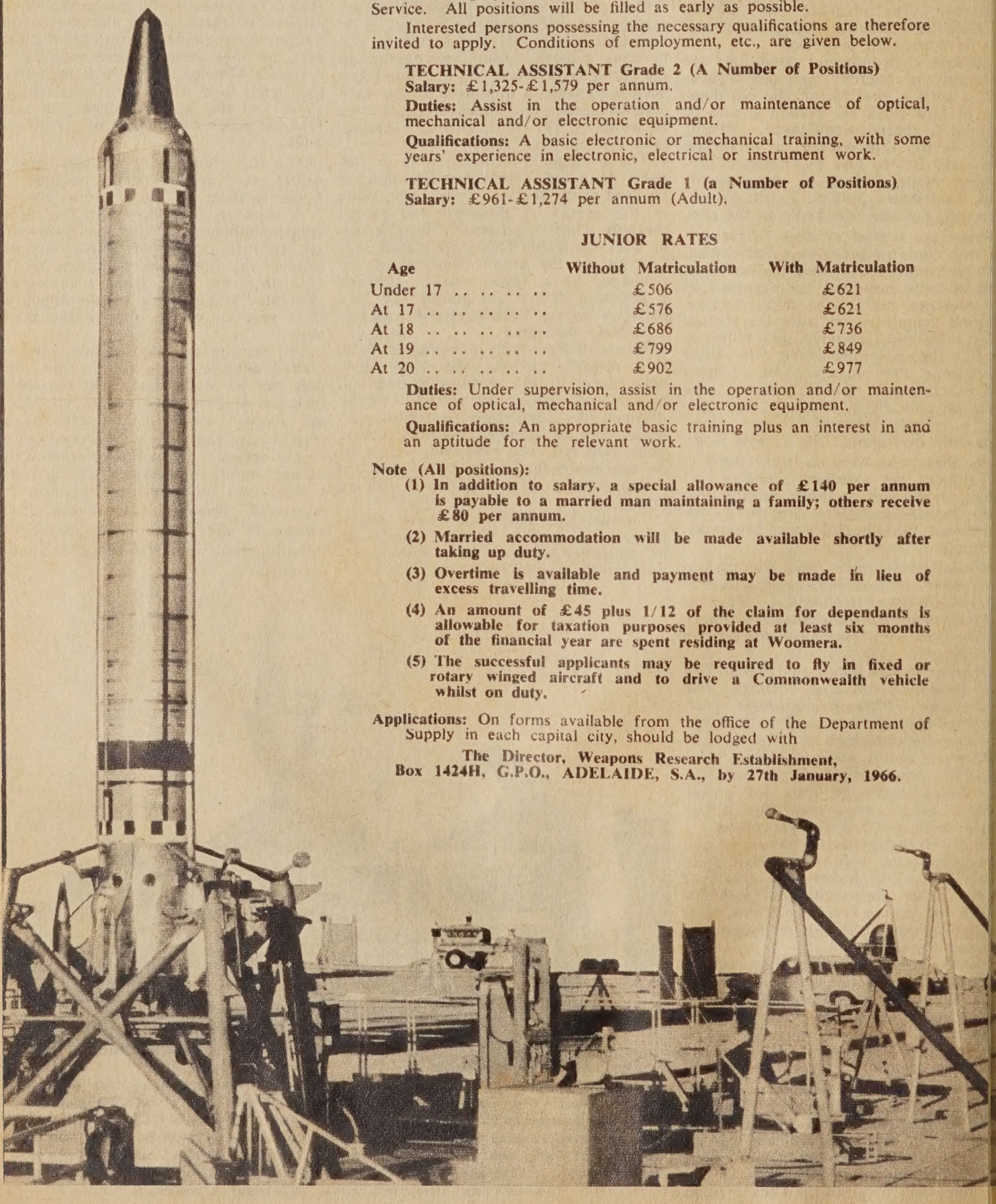

The Weapons Research Establishment is desirous of recruiting staff for a number of technical vacancies at the Woomera Rocket Range.

A number of the positions available are to be filled on a permanent basis offering permanent appointment to the Commonwealth Public Service. All positions will be filled as early as possible.

Interested persons possessing the necessary qualifications are therefore invited to apply. Conditions of employment, etc., are given below.

TECHNICAL ASSISTANT Grade 2 (A Number of Positions)
Salary: £1,325-£1,579 per annum.

Duties: Assist in the operation and/or maintenance of optical, mechanical and/or electronic equipment.

Qualifications: A basic electronic or mechanical training, with some years' experience in electronic, electrical or instrument work.

TECHNICAL ASSISTANT Grade 1 (a Number of Positions)
Salary: £961-£1,274 per annum (Adult).

JUNIOR RATES

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Under 17	£506	£621
At 17	£576	£621
At 18	£686	£736
At 19	£799	£849
At 20	£902	£977

Duties: Under supervision, assist in the operation and/or maintenance of optical, mechanical and/or electronic equipment.

Qualifications: An appropriate basic training plus an interest in and an aptitude for the relevant work.

Note (All positions):

(1) In addition to salary, a special allowance of £140 per annum is payable to a married man maintaining a family; others receive £80 per annum.

(2) Married accommodation will be made available shortly after taking up duty.

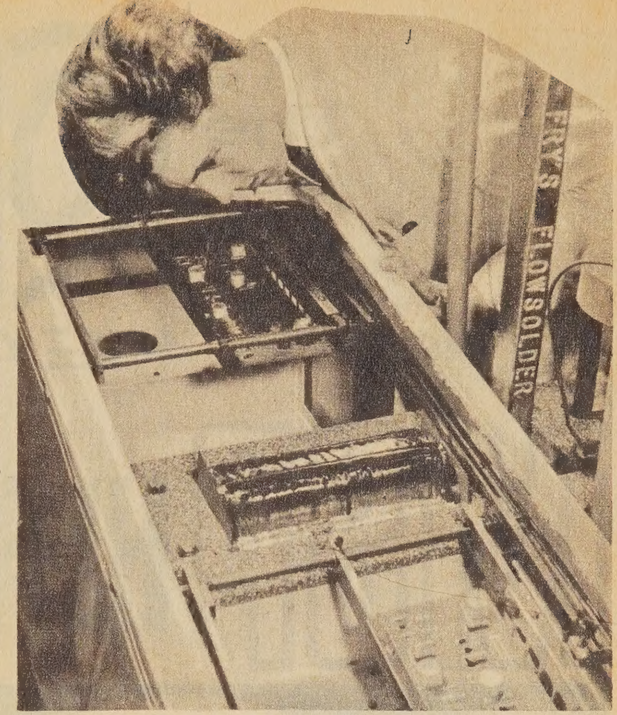
(3) Overtime is available and payment may be made in lieu of excess travelling time.

(4) An amount of £45 plus 1/12 of the claim for dependants is allowable for taxation purposes provided at least six months of the financial year are spent residing at Woomera.

(5) The successful applicants may be required to fly in fixed or rotary winged aircraft and to drive a Commonwealth vehicle whilst on duty.

Applications: On forms available from the office of the Department of Supply in each capital city, should be lodged with

The Director, Weapons Research Establishment,
Box 1424H, G.P.O., ADELAIDE, S.A., by 27th January, 1966.



In this automatic process, complete assemblies on printed wiring boards are attached to jigs on an endless belt. The board moves over heaters, then contacts a moving "hill" of clean solder above the surface of a solder bath. Excellent and uniform soldering results—provided there are no contaminants to prevent the solder from wetting the metal surfaces. (Picture from S.T.C. England).

The instrument in service in Adelaide is the Helmut Fischer design, produced in Western Germany, and designated "Betascope." The electronics are fully transistorised and no warm-up period is necessary. The measuring table is of advanced design, and incorporates a micrometer adjustment for correct positioning of the source to get the best or nearest focal point. A light and mirror inside the measuring table enable the area to be measured to be accurately placed over the platten, and a spring-loaded plunger is used to hold the sample in close contact.

For the purpose of comparison, control specimens have been measured by gravimetric and microscopic techniques as against Beta ray measurement. Microscopic readings generally are higher than either of the others, due to variance in deposit density.

The Betascope system of measurement lends itself admirably to in-production quality control. The work can be held in the final rinse water, a sample taken, and the result known in less than a minute; if more deposit is required, the rack of work can then be put back in the plating bath for the appropriate time.

Alloys like copper/gold, copper/tin, copper/silver, copper/lead, lead/zinc, tin/lead, tin/nickel, etc., can be readily assayed in less than a minute simply by comparison of the count of the sample as compared with a base count of each element, with an inaccuracy of less than a few per cent. In the sorting of metals and alloys this method is invaluable, a simple 15-second count will verify a material's identity.

The Betascope has some disadvantages, however. As previously mentioned, difficulties occur when the atomic numbers are very close. In practice, a difference of three between deposit and substrate is enough at the low end of the scale but, elsewhere, a difference of five is necessary for accurate results. Hence a copper deposit on a steel substrate cannot be measured by this method.

Fortunately, electronics has come up with other methods of assessing coating thickness and therefore of answering the question "How thick is thin?" These methods include:

Eddy currents, where the deposit must be non-magnetic over a magnetic base; by such instruments as the Permascope, a brother of the Betascope; or the Magnagauge, where a non-magnetic coating over a magnetic base is checked by relying on the difference in magnetic attraction due to the increase in gap caused by the copper or nickel deposit.

Unfortunately a composite copper-nickel coating must be recorded as an individual reading.

The Kocour Electronic Thickness Tester is one of the few methods of ascertaining individual deposit thicknesses of composite coatings, but is destructive, and cannot therefore be considered except where the job unit cost is of no consequence, or scrapping the article incurs no production problems. The part must be reworked or scrapped.

Another method developed in this country is by X-ray fluorescence, and is currently being considered by Australian Mineral Development Laboratories, who have in their establishment a Microprobe Electron Analyser capable of doing all sorts of metallurgical assays. The huge cost of such an item of equipment, however, makes it improbable that this method will ever be used for in-plant production control.

However, while the Betascope type of instrument has certain specific limitations as outlined, it can make a tremendous contribution to the control of many critical plating operations vital to the electronics industry. The Quality Control Board, a branch of the Royal Australian Air Force, have checked and certified its use, and all checks can now be supplied with a Q.C.B. Release note.

Non-electric plating offers high accuracy

A NON-ELECTRIC chemical plating technique developed by Sperry Gyroscope Ltd. is now, under the terms of a recent agreement, being offered to industry by Ingram and Glass of Godalming, Surrey, England. The process enables a variety of metals to be plated on to a wide range of metallic and non-metallic substances with a uniformity that is unobtainable using conventional electroplating.

The high penetrating power of the catalysts and sensitising agents employed ensures that every hairline and crevice in the surface to be plated is uniformly seeded with active nuclei. This brings about a deposition of reduced metal into all possible anchorages thus ensuring a positive bond. An example of the potential of the process is shown by the successful through-plating of a 1.25in long hole with a 0.015in diameter, bored through a phenolic resin rod.

If required, a layering process is available whereby considerable thicknesses of different substantially stress-free metals are successively deposited, each layer contributing some particular property of its own.

Metals which have been found best suited for deposition by catalytic reduction, and which are of wide utility in their application, are phosphocobalt and nickel. Other reduction processes produce deposits of copper, gold, palladium, ruthenium and platinum. Silver is a comparatively easy metal to deposit, but it has limitations owing to a tendency to ion migration.

The process enables plating to be carried out on non-metallic substances such as wood, plastics, quartz and ceramics. It therefore has application in the preparation of multi-layer printed circuit boards. An outstanding feature is the facility for coating through-holes of very small diameter.

The rate of coating may be varied according to the particular plating solution, but it is usual to deposit between 0.0006 and 0.0001in of metal every hour. Sperry chemists are undertaking further developments for conventional and specialised projects. A small pilot plant is also available for small batch production. ("Electronics Weekly")

ADHESIVE FELT

A new wool felt pressure sensitive adhesive tape has been developed by Norton Australia Pty. Ltd.

Marketed under the trade name Bear No. 420 Green Felt Tape, the versatile product offers industry tremendous saving in cost and time. It combines the advantages of high-grade wool felt, with the convenience of pressure sensitivity merely by stripping a coated paper interliner from the tape.

Previously, it was necessary to coat or brush the adhesive on to the felt. This was not only time-consuming, but created problems of the adhesive soaking into the felt backing or drying out.

The makers claim there is almost no limit to the tape's potential uses. Areas of application for radio, television, electrical and electronic component manufacturers include sealing, anti-vibration mounting, cushioning and sound proofing.

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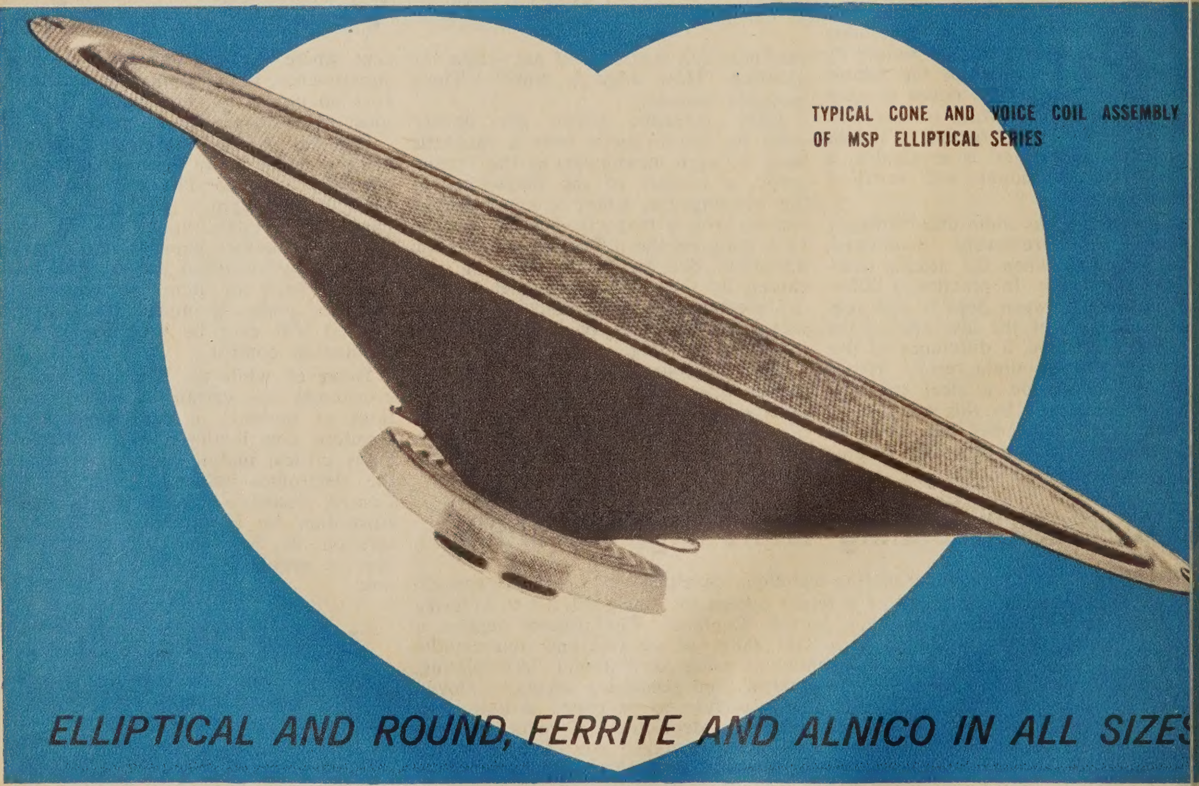

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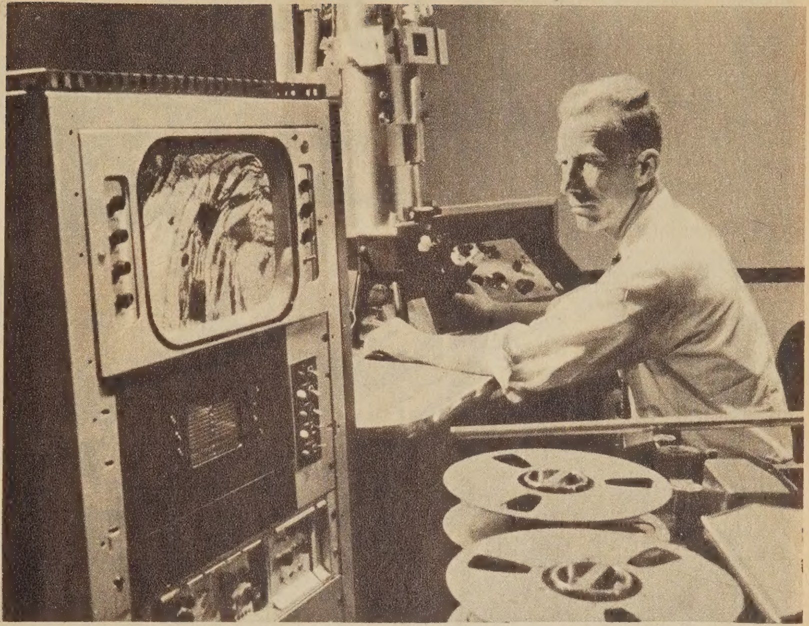
WINDOW on the INVISIBLE

By Edward J. Dudley



The techniques of electron microscopy and television have been combined to give scientists a more effective tool in their exploration of the molecular structure of matter.

A new and brighter window on the world of the infinitely small was opened recently by RCA scientists who successfully merged the techniques of television and the electron microscope. The system holds promise of new knowledge that could help man's exploration of space, his conquest of disease, and his insatiable search for new creature comforts and conveniences. The combination of the two techniques, known formally as a Television Image Intensification System for the RCA Electron Microscope, is essentially an ingenious way of extending man's vision to see and study the building blocks of matter.

THE electron microscope is recognised as one of the world's most powerful scientific instruments. With its 200,000 times magnification and great resolving power, the microscope has illuminated many dark corners of the miniature world.

Experience in electron optics gained in RCA's years of television research played a major role in the design of the first commercial microscope. When the first one was delivered in 1940, the company had reduced the complicated procedures of manufacture—previously attempted only under laboratory conditions—to factory assembly on a volume basis.

Televisions's contribution to the merger was an image intensifier, a device that can make images many times brighter.

The electron microscope, for all its vast powers, has some specific limitations. These centre around the nature of certain specimens that produce images too dim to be useful. The microscope functions by directing an electron beam at a specimen. The electrons that pass through are focused by magnetic lenses, creating a pattern or image of the specimen as they strike the fluorescent viewing screen. The question arose: if the picture on the screen is too faint, why not strengthen the electron beam and brighten it?

The answer, as microscope men had known for some time, was that plastics and other materials of interest to science are radiation-sensitive and are destroyed or altered by electronic energy strong enough to "illuminate" them adequately. With the help of image intensification, a relatively weak beam could be fired at the specimen, and the resulting weak images—some so dim as to be invisible to the eye—could be brightened by the intensifier until they were visible.

A startling effect of combining the two electronic techniques is that images up to two million times as large as the original specimens can be produced. These visible images are ten times as large as the electron microscope alone can show before it runs out of enough brightness for vision.

Although the increase in magnification is a spectacular feat, scientists note that, in practice, most observations in electron microscopy are made at magnifications well below theoretical limits.

More significant to the researcher is the instrument's vast resolving power. This is the ability to distinguish, or visibly separate, infinitesimal objects.

The human eye, for example, resolves or sees objects as small as 1/250th of an inch in diameter. With the help of the light microscope, objects as minute as 1/125,000th of an inch can be distinguished. But when the same scene is viewed with the electron microscope we can even see particles 1/25,000,000th of an inch in diameter.

This tremendous resolving power is a great advantage in micro-photography, when it is required subsequently to enlarge sections of a picture for detailed examination. Images photographed with the instrument's camera produce such sharp pictures that they can be "blown up" many times the original size, and still retain meaningful detail and contrast.

RCA's TV image intensification system, which was demonstrated for the first time in September, 1964, at the company's Camden, N.J., laboratories, is so new that its impact on scientific progress is yet to be assessed. But it is being hailed as the most important single advance in microscope design since the perfection of the electron microscope itself.

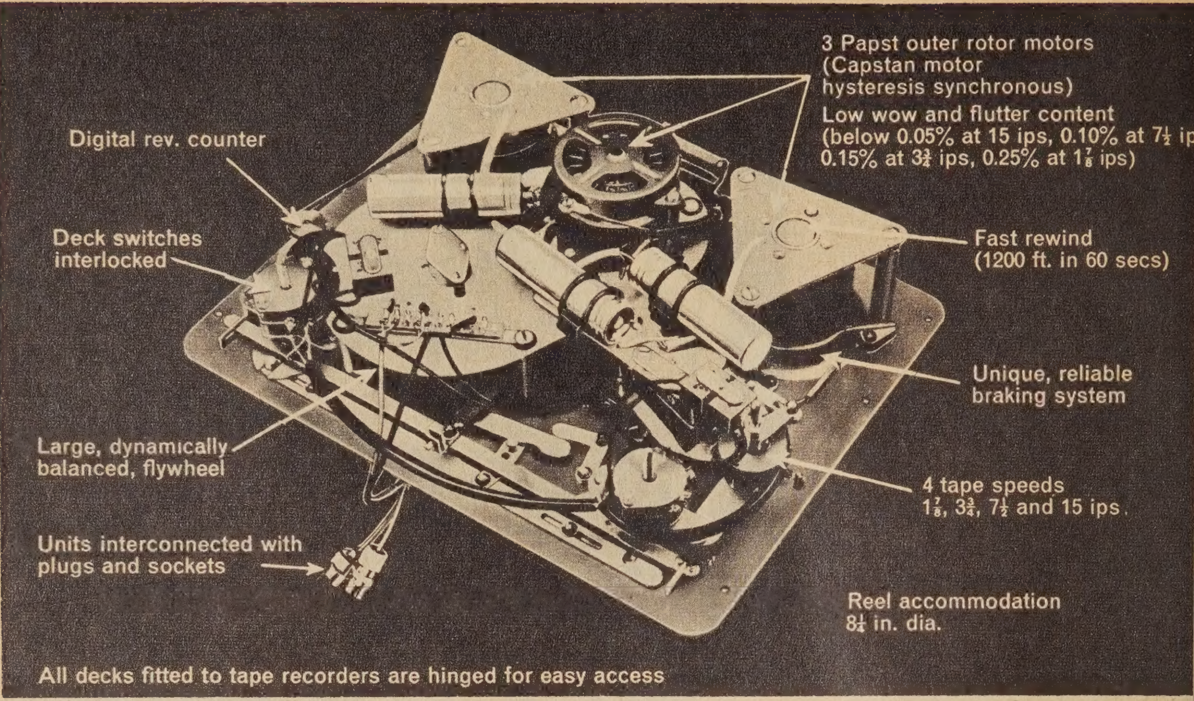
The system holds advantages beyond the major one of allowing researchers to view for the first time specimen images that had been beyond the reach of electron microscopy.

The TV system enhances the microscope image by providing a greater degree of picture contrast. Specimens difficult to distinguish because of poor contrast can be made to project "good pictures" that are meaningful to the microscopist.

Another benefit TV brings to microscopy is its ability to invert images. Because of the nature of their preparation, some specimens appear on the viewing screen as photographic negatives. By a flick of the switch, which reverses the polarity of the TV signal, the images can be made positive and quickly become understandable.

Other advantages are inherent in the ability of television to portray motion. Scientists frequently are interested in how the appearance of a specimen changes as temperature is raised or lowered, as the specimen is stretched, or

(Continued on page 11)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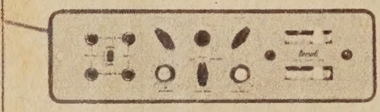
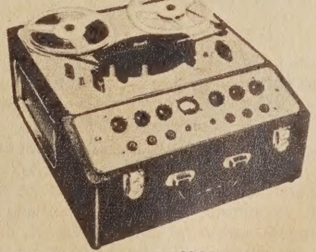


THE BRENELL HI-FI TAPE LINK

As most owners of High Fidelity sound reproducing equipment will know, tape recordings cannot be made from the amplifiers and pre-amplifiers by simply connecting a tape deck to the sockets marked record, a vital 'Link' between tape deck and amplifying equipment is required.

The Brenell Hi-Fi Tape Link contains twin recording amplifiers, "Push-Pull" Bias/Erase oscillator, twin playback pre-amplifiers and is designed for use with the Brenell three headed stereophonic tape deck, i.e., separate Erase, Recording and Playback heads (¼ or ½ track stereos) and any make of High Fidelity amplifying equipment capable of supplying a signal level from Radio Tuners, Microphones, Gramaphone Pickups, etc.



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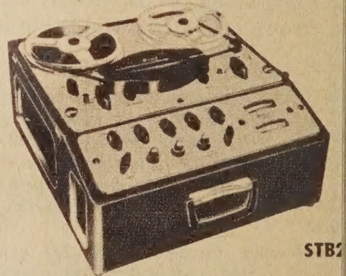

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as a magnetic field is applied. These events can be made to happen in the microscope's specimen chamber, and the results watched on a TV monitor.

And, by connecting a video tape recorder to the system, the changing picture can be captured on tape for playback immediately or at any future time. Thus, the microscopist has a pictorial record of "transient phenomena"—events that happen only once or at unpredictable times—to study over and over again.

Taped or live television pictures of specimens under examination can be fed into a closed-circuit TV system for viewing at any number of locations, or used on the air in broadcast programs. The addition of TV takes the electron microscope out of the essentially "one-man" class and permits classrooms of students to share the microscopist's view as he manipulates the controls.

The television recording and display features of the new system will enhance the microscope as a teaching tool, especially in medicine and other life sciences, and in the formal training of microscopists.

In earlier years, this training process was a long one, for the student had to know as much about the instrument as he did about preparing specimens and interpreting what they revealed. Modern technology has sharply reduced the equipment end of such training by automating many of the functions of the electron microscope, allowing the researcher to concentrate on his viewing screen.

This is evident in the new TV system, which uses a small transistorised camera with many self-adjusting features. The camera is equipped with a three-inch image orthicon of extremely high sensitivity. This is the pickup tube type used in broadcasting studio cameras. The fact that a TV camera with associated image intensifier could be added to a complex assembly, already crowded with 4,300 parts and 80 miles of wiring, points up the extent of the engineering achievement. Moreover, the merger had to avoid any interaction between the magnetic fields and high-voltage equipment of the two electronic systems.

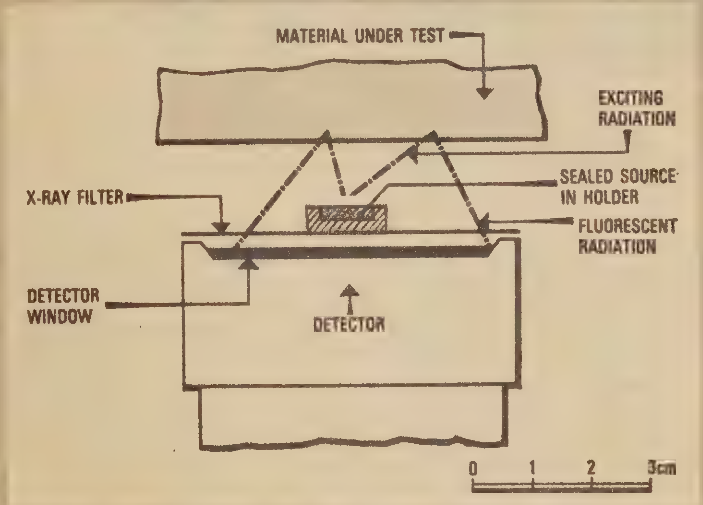
The 1,200 RCA microscopes produced during the past 24 years are making their influence felt in every branch of science. They have uncovered clues that may help to find a cure for cancer and have given medical researchers their first view of polio and other viruses. Metallurgists use electron microscopes in building the exact alloys demanded by the space age. Tyre manufacturers study and recreate molecules of natural rubber with them. Governments use them to examine minutely the air we breathe and the ground we walk on.

The period since 1940 has seen constant improvement, refinement and simplification of the RCA electron microscope. The long-term aim is to broaden the instrument's area of usefulness by making it as easy to use as the light microscope.

In the new breakthroughs it foreshadows and the new knowledge it promises, television image intensification appears to surpass all of the advances made thus far in electron microscope design. With it, science, has more powerful eyes to explore the mysteries of the molecular realm. ■

PROSPECTING WITH ISOTOPES

A portable instrument that can be used to detect instantly a particular metal in an ore sample, and the amount present, has been developed in the U.K. by the Geological Survey (Atomic Energy Division) in conjunction with the U.K. Atomic Energy Authority and Hilger and Watts Limited.



Schematic diagram showing relative position of radio isotope source, sample under test, filter and detector. X-ray fluorescence excited in the test sample by radiation from the source passes through the filter to the detector.

This new instrument has been designed for use in mines by geologists and engineers and in the field by prospectors and geologists. A radioactive source in the form of a small disc, 1cm in diameter, is contained in the scanning head and is shielded by a safety shutter which can only be opened when the head is pressed against the sample. The source excites X-ray fluorescence in the specimen and the secondary radiation characteristic of the element sought is selected by filters and detected by a scintillation counter.

The head of the instrument is connected to a scintillation counter rate meter which is transistorised and fully sealed. The instrument weighs 16½lb, is powered by either dry cell or rechargeable nickel-alkali batteries and is designed to work within a temperature range of 0—45 degrees C.

In using the instrument, a source is selected with an emission of suitable energy to excite the characteristic X-rays of the element sought without undue excitement of background radiation.

Some sources can be used for a range of elements, but specific filters must be chosen to isolate the characteristic radiation of each element. The thickness of each filter is adjusted so that for a sample containing none of the element sought, the count rate is the same whichever filter is in position (i.e. zero difference). To obtain a reading the probe is pressed against the sample and the trigger operated to swing the safety shutter aside. With the probe still in position, the filters are switched and a second reading obtained. The difference between the two count rates is proportional to the concentration of the wanted element.

The present instrument has been used extensively with tin ores as the test substance with sensitivity down to 300 p.p.m., but its use is being extended to copper, lead, zinc and other metals. Tin was selected as test material because of the difficulty in recognising it by other methods, the protracted chemical analysis necessary, and the present tin shortage.

This instrument, which was shown for the first time at a Physics Exhibition in Manchester, should prove a valuable aid in the search for, and exploitation of, new metal deposits throughout the world. A similar instrument, operating on the same principle, but for use in measuring the composition of alloys and thickness of coatings in the metallurgical, plastics and electronics industries is commercially available. ("Mining and Minerals Engineering.") ■

A typical process worker's environment. No matter how well planned the factory, the very nature of the work creates monotony. Planned musical programs are designed to relieve this condition, for the benefit of workers and management alike.

PLANNED MUSI FOR INDUSTRY

One of the undesirable by-products f modern mass production techniq s is the sense of monotony and frustrat n which the constant repetition proces s create for the worker. One w y to minimise these effects, it is claimed is to present carefully planned musi l programs at selected intervals during the d . The planning and distribution of s h programs is described in this artic .

By Calvin Walters

DOWN through the ages from early days of man, music has been recognised as having an influence on human behaviour. These influences can be harmful or beneficial according to the circumstances at the time. The fact that music has soothing properties has been used, for instance, in the practice of witch doctors of various tribes, who seemingly "cure" their patients with a mixture of incantation and dancing. As will be seen later, the more scientific approach of today is the use of music in hospitals and operating theatres.

In the pages of the Bible there is an Old Testament verse which reads as follows, "And it came to pass when the evil spirit from God was upon Saul, that David took an harp, and played with his hand. So Saul was refreshed, and was well . . . ." This is one of the earliest references to the use of music in healing.

Some music is deliberately designed to produce certain effects on the human emotions. This is evident in church music, military music, dance music, funeral music, festival music and so on. Most married people know the numbing effect of the Wedding March which led us up the aisle to the altar. Others know the effects of a stirring march played on a band which helped them into the army recruiting booth. Then, of course we have Beatle "music," that modern phenomenon whose effects are so well known—if not understood!

In other words, music has been adapted to the fundamental needs of man. Further instances are the blare of bugles ushering men into battle, special music designed as background music for advertising purposes, music to gain attention to some event, music for dancing, church music for the various events, weddings, births and deaths, and, of course, praise.

Music designed for accompaniment to work has been known from early times. Many Egyptian inscriptions have figures playing trumpets and other instruments, over figures who are working. The Chinese were noted users of music for this sort of thing. The American Negro was famous for his rythmic singing, keeping in time with such things as the blow of hammers or the sound of a machine, the trot of animals, etc. Then there are the sea chanties, folk songs, and so on.

Exactly when industry first used music to "pep" up their staff is not known. The Industrial Recreation Association of Chicago reports that, "In 1876 John Wanamaker installed a small organ in his Philadelphia store, which was opened every morning with the employees singing favourite hymns and other songs." This apparently had a double-barrelled effect by getting the staff in a good mood and, at the same time inducing the customers to come in and purchase.

With the advent of electronic means for transmitting music it was inevitable that somebody would hit upon the idea of using the stimulating aspect of music as an accompaniment to work. The idea apparently evolved in the brains of two British Industrial psychologists S. Wyatt and J. N. Langdon, who in 1934 experimented with the use of music in factories and published a paper thereon.

Early in World War II, Britain, faced with the threat of Hitler, seized upon the idea of "music while you work" to boost morale and production in aircraft and munitions factories. Thus with the impetus of war, industrial broadcasting in England became established. So beneficial was it that Senator William Benton in the U.S.A. was impressed to the extent of establishing the Muzak Corporation, now one of the most successful enterprises of its kind in the supply and installation of industrial sound systems and to whom I am indebted for much of the information required for this article.

The early methods of broadcasting music while you work involved three main types of equipment. (1) A central plant system where records were played through a record player wired to loud speakers throughout the building. (2) By allowing each area in the plant to have its own record player and library, and (3) by supplying a radio set to each group of workers so that they could listen to whatever they wished.

Of the three systems that of a central studio was the best, in that some semblance of musical psychology could be applied to the choice of music broadcast throughout the system. This is a very big problem associated with music-while-you-work systems. Most compa ies have no solution to the problem o separating the office and supervisory af from the factory workers, but the pe of music required differ for these types of workers. How this has le solved by such firms as Muzak wil be seen later.

In a book "Music In The Mo r World" by Myers', 1939 edition, t re is an interesting section dealing with h question of listening to music as dis from hearing it. Little did he think at this difference is the very basis of h modern "music while you work" sys m which are now "piped" over telep ne wires by firms such as Mu k Experience has shown that, for es results, the type of music which st be broadcast is the type that is "h rd but not listened to."

With the advent of this mo rn "piped" music, the days of hapha rd broadcasting of industrial music re gone. There is no more broadcastin o music totally unsuitable to the wor in hand. Office music and factory m sic is properly controlled and planned. ou will hear no vocal items which dis act attention. No loud passages and su en changes of volume and tempo. Ins a there is a constant flow for fixed pe ds of music specially recorded which vi suit ALL offices and ALL factories of the same kind.

This has been described in "The us tralian Factory," May, 1963, as foll ws "The music might be described as subliminal—it is like the TV adver sement that flashes momentarily on to he screen and penetrates the subcons us mind without hammering the consc us. Basically, the music does not den nd attention as music on a radio or re rd player might do."

The music is not specially comp ed for the purpose. It is mainly in ru- mental music, consisting of well-kn wn melodies specially arranged with the in of " 'controlled emotional stimulus' b ed on energy-ebb charts for particular t es of the workers' day and activity. he music is designed, for instance, to ve the workers greatest 'lift' in the pe ds following low energy-ebb times of id- morning and mid-afternoon."

The music is not played faste or

louder in order to accomplish these "lifts." On the contrary, there is a scientific arrangement of the melodies by tempo, rhythm, size of orchestra and type of instruments. All sudden transients, changes of tempo and other characteristics of the music which distract attention are eliminated. The music is recorded on tape with a frequency range of 40 to 8000cps.

It has been found that there are neutral tunes which have no effect on the human being as measured on an encephalograph (brain), cardiograph (heart) and other testing instruments including blood-pressure measurements. These are tunes which have about 70 beats to the minute in a 4/4 foxtrot time played on an orchestra of 12 instruments of woodwind and brass. It is assumed that the reason for this is that the beat is so close to the heartbeat of 72 beats per minute.

"If the tempo is increased or decreased a feeling of acceleration or relaxation is induced accordingly. Similarly, rhythm, size of orchestra and type of instruments are used to bring about transquillising or stimulating effects" (Australian Factory)

The contents of the musical programs is varied to suit particular kinds of worker audiences. For factory workers it is generally speaking 3 per cent novelty, 81.5 per cent popular rhythmic, 14.2 per cent popular melody and 1.3 per cent concert. For office workers it is 1 per cent novelty, 38.2 per cent popular rhythmic, 56.2 per cent popular melody and 4.6 per cent concert. These figures have been obtained after exhaustive tests involving a great many questionnaires to management, office staff and factory workers.

This is "planned music" in the real ense of the term. The principle behind t, which seems to have much to support t, stems from the belief of many ndustrial psychologists, that tension is n underlying influence behind worker nefficiency. This tension is brought bout by monotony, boredom, and atigue in process jobs. Jobs involving epetitive work generally are confining nd lack interest. The worker becomes ense and turns to forms of escape such s day dreaming, idle gossip away from he work, or sneaking out for a smoke. he result is deterioration in work and norale.

Planned music, it is claimed, defeats hese things by overcoming workers' ension and keeping them more alert and efreshed. One interesting aspect of this ind of music is that it helps to mask oise in noisy factories caused by machnery, and noise in offices caused y traffic, typewriters, etc.

Not only is music piped by landlines o factories and offices, but scores of octors and dentists waiting rooms are onnected, as is also the labour ward f the Royal Hospital for Women in addington, N.S.W. Here it was found hat mothers-to-be in the Outpatients ept. were clearly relaxed under the fluence of the music. For the same eason it is now used in the labour ward. is also installed in the Austin Hospital, elbourne, and in the cardiac operating eatre of the Royal Children's Hospital, elbourne.

In the Royal Children's Hospital Melourne the cardiac surgeon reported in People," August 11, 1965. "I have no oubt that the music relieves some of e tension in the operating team performing hole in the heart operations without causing any observable lack of concentration on the job in hand." Parents in the waiting room are also far less emotionally disturbed under the influence of the music. In America it has been found that music in the dentist's office or in the hospital operating room reduces the amount of pre-anaesthetic sedation and local or regional anaesthetic required.

Quoting again from "People," "Dr Ira M. Altschuler, a noted American psychitrist who directs musical therapy at Wayne County Hospital in Detroit, has reported that the mental and spiritual drug of music enters the human being through the thalamus, a part of the brain that is the main relay-station for all the emotions, sensations and feelings. Music gets to us because man is essentially a rhythmic being with rhythms in respiration, heart beat, brain-waves, gait, and speech."

So, today, music is "piped" through land lines to such places as offices, factories, banks (instance the Rural Bank, Sydney), supermarkets, hotels, restaurants, dentists' surgeries, hospitals, blood transfusion centres (instance the Red Cross Blood Transfusion Centre in Sydney).

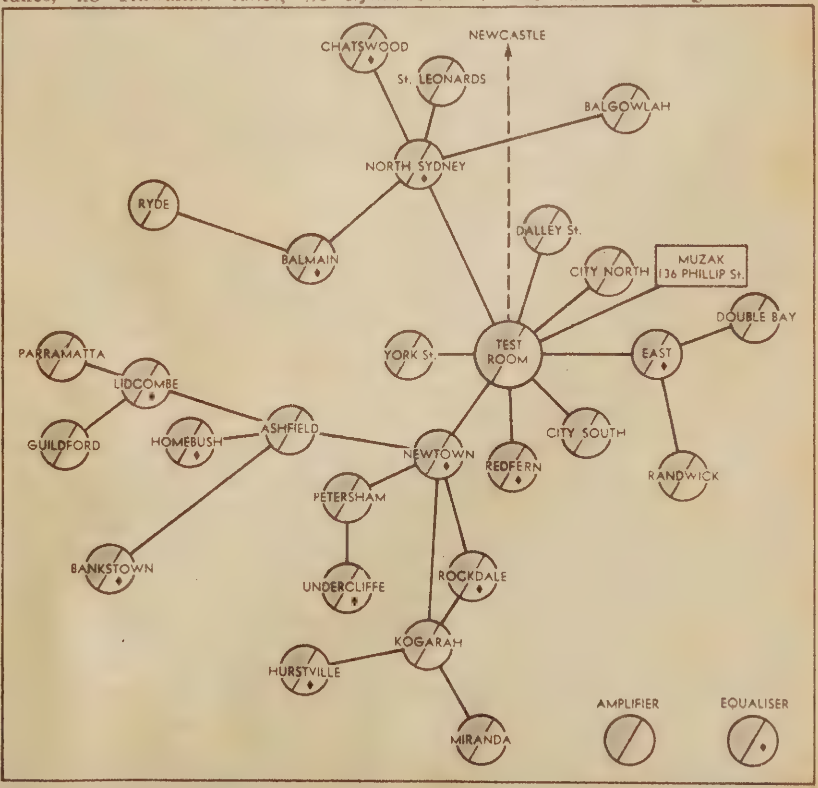
In addition to factory and office music there is a third kind called "public area" which goes to hotels, shops, waiting rooms and so on. This is a blend of office and factory music. Office music is placid orchestrations, with no prominent instruments or beat. Factory music fights noise and promotes rhythm so is stronger, brassier, and has more swing.

You will hear no symphonies, concertos or sonatas in the music transmitted by Muzak. But you will hear the melodies of Rodgers, Cole Porter, and Frederic Loewe. There are no rock and roll tunes, no Hawaiian tunes, no hymn tunes. The first are too rhythmic and too loud and too many words to listen to. Hymn tunes make people want to join in and do a bit of harmonising. And you can't play tunes with "danger" titles such as "I've got a feeling I'm falling" to passengers in an aeroplane. Although they are not supposed to listen to the music, experience has shown that they pick out tunes of that nature and justifiably become a little nervous.

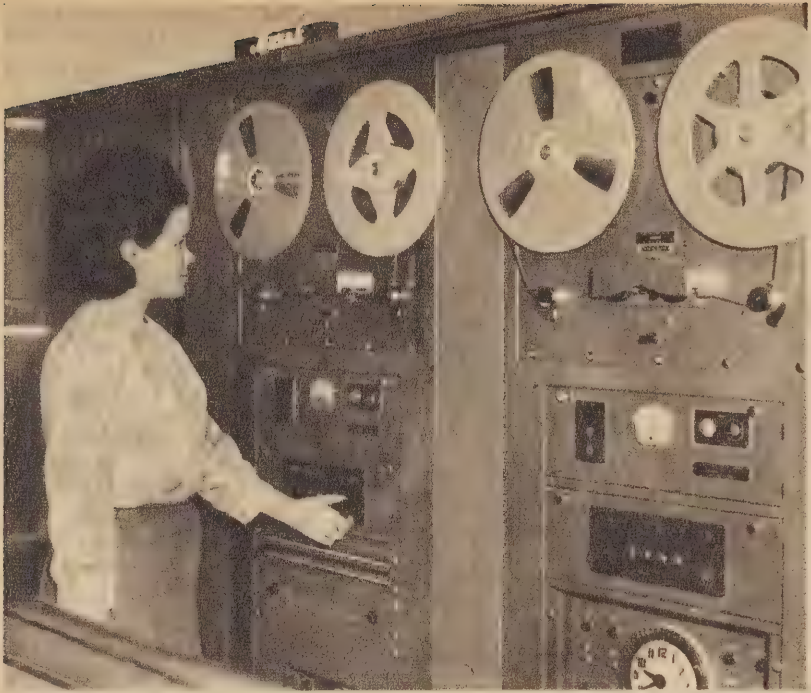
Just as important as playing the music is the discovery that it is necessary to have breaks from it. It has been found that four hours of music at 15-minute intervals in an 8-hour day is sufficient. For some unexplained reason the good effects of the music is more or less cancelled if this time is exceeded. So the music for factories and offices is regulated to this period. In Public places no such restriction is necessary, for obvious reasons.

The tape recordings of the special music are prepared in the studios of the Muzak Corporation of America on tapes of 8 hours capacity. No program is played more than once in any one factory or office. When a tape has been used once by all subscribers in Australia, it is returned to America and a new program recorded on it. The Muzak Corporation library now has more than 7,000 tune titles valued at more than £6-million. The library records more than 200,000 miles of tape annually.

In the Sydney studios of Planned Music Sydney Pty. Ltd., 136 Phillip Street, who handle Muzak in Australia, there are three tape playback units. Each unit is designed to reproduce an eight-hour tape and when played consecutively run for a total of 24 hours. The tape is 4,800 feet long on a 14-inch spool and has a recording speed of 3¾in per second. Half track recording is used so



The distribution system for "Muzak" programs in the Sydney metropolitan area. The programs go via P.M.G. lines to each district, and from the P.M.G. exchange to each subscriber. The lines carry both program and coding signals.



The three tape machines and control panels at the "Muzak" headquarters in Sydney. The master clock which controls the 15-minute sessions is just visible on the nearest rack.

that the eight-hour tape contains 32 14-minute 27-second program segments. Sixteen of these are on the forward half-track and 16 on the reverse half-track.

In addition to the playback units, facilities are provided for cueing, monitoring, extraction of office and industrial programs and to supply the programs to up to 50 P.M.G. exchanges.

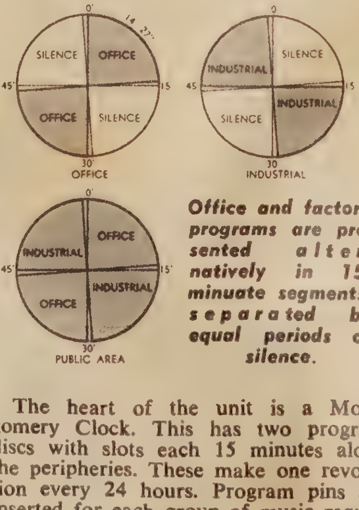
The Muzak tapes contain two types of programs. One is the office program and the other the factory or industrial program. A combination of these two provides the program for public areas, restaurants, waiting rooms, etc. Subscribers to the office or industrial programs do not receive continous music. Recording of the two types of program on a single tape is achieved by interleaving the program segments of the office and industrial programs as shown in the diagrams.

The 14-minute 27-second segments of music are divided further into periods of 12 minutes and 2 minutes 27 seconds. The 2-minute 27-second period is used for special program material, which may or may not be transmitted to the subscriber according to the setting of a toggle switch.

The program is started at the beginning of each quarter hour period by the master clock. The program segments of 14 minutes 27 seconds allow for any tape stretch and ensure that the program will always commence exactly on the quarter hour. In addition to the programs, 25-cycle tones of varying duration are recorded on the tape to control the operations of the playback units.

The duration of the 25-cycle tones and their functions are:— Three seconds: to mute the program at the end of each 12-minute program period. Eight seconds: to mute and stop the reproducer after each 14-minute 27-second program segment. Sixteen seconds: to mute, reverse the direction of travel of the tape and stop the reproducer after the first four hours of the eight-hour tape. Forty seconds: To switch to another playback unit and switch the operating unit off at the end of the eight-hour tape. Time pips from the G.P.O. service are also fed into the circuit by special arrangement.

An important piece of equipment at the studio is the Single Channel Program Extractor. As has been described, both the office and industrial programs are recorded on the one tape. This is called the basic program. The purpose of the Single Channel Program Extractor is to extract each of these programs in their proper order after the 14-minute 17-second transmission.



Office and factory programs are presented alternatively in 15-minute segments, separated by equal periods of silence.

The heart of the unit is a Montgomery Clock. This has two program discs with slots each 15 minutes along the peripheries. These make one revolution every 24 hours. Program pins are inserted for each group of music required. One disc is for office programs and the other for industrial programs. Each time a pin operates the Montgomery Clock program contact actuator, a timer is started which operates relays. Thus each program is transmitted in turn. The Single Channel Program Extractor initiates impulses. The switching is actually carried out in the splitting amplifier in the various exchanges.

From the studio location the program is transmitted over a pair of wires to the P.M.G. test room. A second pair of wires carries the control signals used to separate the office and industrial programs. All program transmission is over broadcast quality land lines.

From the test room, both program and control signals are carried over a single pair to the next exchange. The control signals over this circuit are direct voltages applied between the centre tap of the program transformer and earth. By reversing the polarity, polarised relays at the exchange may be operated so that the program is alternately connected to the appropriate groups of subscriber's lines, according to whether office or industrial programs are being transmitted at the particular time.

At the exchange the program is fed into a splitting amplifier from where it is transmitted to up to 100 subscriber within the area served by the exchange This exchange also transmits the signal via another line to the next exchange where another splitting amplifier serve up to another 100 subscribers. This is carried out indefinitely from one exchange to another according to the diagram reproduced herewith. Where required, equalisers are provided at various exchanges to compensate for th loss of high frequencies during transmission.

At the present time Muzak serves 35 subscribers in Sydney and Newcastle and 240 from the Melbourne studios. Ther is a direct line from Sydney to Newcastle exchange.

One method of distribution used overseas employs the normal FM broadcas channel, the factory music being multiplexed with the regular program in such a way that normal FM receivers do no respond to it. Special FM receivers supplied by the company, are installe on subscribers' premises, and extract th multiplexed signal and reject the broadcast program.

At the subscriber's premises the program is fed into a low level qualit amplifier of about 5 watts output. Th maximum volume level allowable fo the installation is preset at the amplifier, the subscriber being able only t turn the volume down if required. Th output goes to eight-inch loudspeakers usually mounted in the ceiling. Eac speaker covers an area for sound o about 400 square feet. It is stressed tha the volume of sound is at a very lo level at only a fraction of a watt outpu

The equipment is rented by the subscriber at a charge depending on th type of service needed and, it is claimed planned music in the office and industry pays dividends in the same wa as does good and pleasant working conditions, planned lighting, ventilation an colour.

John Armstrong (1709-1799) said i the "Art of Preserving Health":

"Music exalts each joy, allays eac
grief,
Expels diseases, softens every pain
Subdues the rage of poison and th
plague,
And hence the wise of ancient day
adored,
One power of Physic, Melody and Song.

THE NEW CELESTION "DITTON 10"

Without doubt, this (12¾in x 6¾in x 8¼in) speaker system is the most advanced compact 10 watt high fidelity speaker system available in the world. Frequency response is conservatively quoted at 35-15,000 c s. Available in Walnut and Teak finishes. (See reviews Page 41, June "Gramophone" and "Hi-Fi Guide," Page 433, October issue. **£29/10/**

THE NEW ENCEL X1212 STEREO AMPLIFIER

A completely new X1212 Encel amplifier is now available — with new features including improved design and performance. Many hundreds of the previous model were sold — now the X1212 is better than ever! 12 watts RMS output each channel, 30-50,000 c s frequency response, input sens. 4mV. Although the specifications have been improved the price is still **£44/10/**

KELLY SPEAKERS

The name Kelly and loudspeaker quality are synonymous. Encel Electronics are Kelly distributors . . . This is why the price is lower than ever. The Mk. III 12in bass unit is priced at **£19/10-**

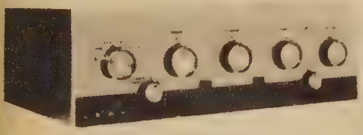
And the famous Kelly Ribbon tweeter (Mk. II) is also **£19/10-**

This renowned tweeter is the most effective treble reproducer ever released, regardless of price.

Crossover to match **£5/10/-**

DICTATING MACHINES IN STOCK

Stenorette, Philips, Geloso, Olympia, etc.



LEAK "STEREO" 30

Now can be the best time to change your stereo amplifier to solid state equipment. The Leak Stereo 30 is smaller, lighter and more reliable—and the Encel trade-in price will delight you. Write straight away for your price!

TAPE RECORDERS

Warehouse stocks at the moment include the new **OKI** FT2020, the **REVOX** G36, TANDBERG model 64 and 74B, Brenell, Akai M8, 707, X4, Philips EL3548, EL3549, EL3300, National 703S, 705, 755S, Sony 200, 357 4, 500a, Grundig, Ferguson, Truvox. Manufacturers agreements forbid advertising prices. Please write now for your personal quote. If the recorder you require is not listed, it's probably in stock. Write now for an E.M.Q.!

TURNTABLES NOW IN STOCK

Orpheus, Labcraft, J.H., Lenco, Garrard, Thorens, Dual, P.E., etc.

THE LUX SQ11—SOLID STATE STEREO AMPLIFIER

Throughout Australia customers report outstanding results with the SQ11. Twenty watts RMS 40 HMS output in each channel, 4 mV input sensitivity, scratch and rumble filters, loudness control and separate bass and treble controls are major features. Come to the new auditorium at 431 Bridge Road, Richmond and hear this remarkable stereo amplifier. Only **£69/10/**

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When ordering be sure to give your full address, printed in BLOCK LETTERS. All equipment is carefully packed to ensure safe delivery. All orders are despatched promptly.

CONNOISSEURS' OPPORTUNITY

Now and again we have price-crushing offers to make . . . this month we offer a brand new LEAK "Stereo 30" solid state amplifier and two new KEF "Celeste" speaker systems, incorporating the new model KEF tweeter. Price **£190**

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We are now carrying a selection of cameras and propectors and deliveries of the following items is ex-stock. All photographic equipment is brand new. Here are examples of the Encel price structure.

PROJECTORS	Retail	Encel.
Braun Paximat Deluxe N24	£79/10/	£59/12/6
Braun Paximat Triumph L	£47	£35
Leitz Prad Olux	£46/16/0	£34/18/0
Leitz Pradix	£29/11/6	£18/15/0

UNIQUE ENCEL STEREO SYSTEM WITH 5 SPEAKER ENCLOSURES

If you wish to purchase a complete stereo system at budget rates, this outstanding offer must interest you. Included are the Star SA30 stereo amplifier — 10 watts RMS each channel, Labcraft 643 turntable fitted with B and O stereo diamond magnetic cartridge, two "Encel-ette" 5 speaker systems with oiled walnut or teak cabinets. Each speaker system employs four 6½in speakers and one 2½in tweeter **£95**

The new model Encel X1212 stereo amplifier may be substituted without additional cost!

AMPLIFIERS NOW IN STOCK

LEAK, Roland, Pioneer, Lux, Trio, Encel, etc.

KEF SPEAKERS

The new model KEF "Celeste" with the improved KEF super-tweeter is now in our showrooms. HF performance is considerably improved with the new treble unit. Check our price now on this remarkable wide range system.

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Celestion

Studio Series

Celestion speakers are internationally acclaimed and are used by professional studios all over the world. Both models feature co-axial treble and bass units with electrical crossovers at 4 kc/s. These advanced speakers are worthy of the most effective high fidelity amplifying system. Read the reviews in the April "Gramophone" (Page 511) and June "Hi-Fi News" (Page 73). The standard Model CX-1512 is rated at 15 watts RMS.

£19/10/-

The De Luxe Model CX2012 is rated at 20 watts RMS.

£29/10/-

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Everyone is familiar with an EMF . . . but what is an EMQ? Our mail order department procedure has been streamlined in order to give you better than ever mail service. Ask for an EMQ . . . an Encel Mail Quote. No matter what you want, even if it is not listed, we will give you an EMQ with alacrity. Spend fivepence on a stamp and save a fortune!

EXCLUSIVE ENCEL OFFERS FOR JANUARY

1 The new Garrard Lab 80 automatic turntable with 660E elliptical diamond cartridge **£55**

2 Sansui SM34 stereo amplifier with AM/AM/SW tuners, Garrard Lab 80 automatic turntable with ADC cartridge, two 10in Wharfedale RS/DD speakers. **£148**

3 Garrard 401 transcription turntable, Pritchard tone arm and ADC 10-E cartridge. **£92**

4 Pioneer 204B stereo amplifier with AM/AM/FM/SW tuners, Labcraft 605 turntable, All Balance tone arm, ADC 770 diamond cartridge, two Celestion "Ditton 10" speaker systems **£164**

5 Leak "Stereo 30" fully transistorised stereo amplifier, two wide range Celestion CX 2012 co-axial speakers **£159**

6 Mullard 6GW8 4 watts per channel stereo amplifier in case, Labcraft 643 turntable with diamond cartridge, two Wharfedale 8in speakers. Outstanding value at **£55**

7 The renowned Star SA-30 stereo amplifier (or the new Encel X1212), Labcraft 605 turntable, J.H. tone arm, ADC 770 stereo diamond cartridge, two twin cone 10" Wharfedale RS/DD speakers .. .. **£94'10**

(Richard Allen or Stentorian speakers may by substituted.)

- With Sony TC 250 a stereo tape deck, 2 speeds, fitted with recording and playback amplifiers **£164**
- Supplied with Grundig TM45 3 speed. 3 head stereo tape deck fitted with recording playback amplifiers (as used in the TK46 retailing at £240). **£179**

8 Pioneer SMB161 stereo amplifier with AM/AM/SW tuners, Labcraft 643 turntable fitted with B and O stereo diamond magnetic cartridge, two 8" Wharfedale RS/DD speakers **£94**

(With Labcraft 605 t/t, All Balance tone arm and ADC 770 cart. £104

EARLY ENCEL SPECIALS STILL AVAILABLE

The Special offers made from time to time by Encel Electronics in "Electronics Australia" (Page 15) are kept open for several months. In the majority of cases, the prices quoted are still applicable. Please check with us!

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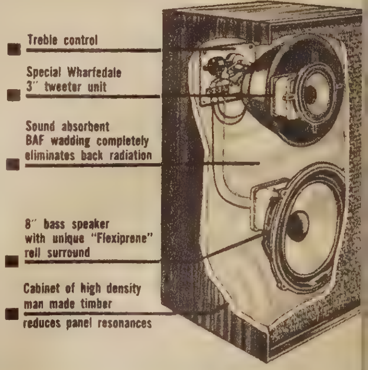
Which Compact Speaker System Offers Higher Sensitivity And Effective L.F. Performance ?

THE NEW
WHARFEDALE
Linton

Analytical appraisal of the development of miniature speaker systems reveals a compromise . . . the losses being in the lower registers and sensitivity. The new Wharfedale "Linton", although only 19" x 10" x 10", offers high fidelity sound reproduction with substantially linear bass response, excellent transient performance and high sensitivity due to the use by Wharfedale of large magnet assemblies. Two completely new Wharfedale units are featured in the "Linton" . . . an 8" bass speaker and a tweeter developed from the famous Wharfedale "Super 3". An entirely new roll surround, Wharfedale Flexiprene, reduces the basic resonance of the woofer to only 43 c/s. Overall frequency response of the "Linton" is 40-15,000 c/s, power handling capacity 10 watts r.m.s. and impedance 8 or 15 ohms.

Styled by one of Britain's leading industrial designers, Robert Gutmann, the Wharfedale "Linton" cabinets are fabricated from low resonance man-made timber, finished in selected walnut or teak veneers. Lining is acoustic B.A.F. wadding to minimise cabinet resonances.

As world leaders in the field of sound reproduction, Wharfedale were reluctant to release a compact system until Wharfedale standards of sound were satisfied. Where smaller speaker systems are desirable, the new "Linton" offers fine performance standards designed to satisfy the most discriminating music lover. Listen to the new Wharfedale "Linton" today!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N.T.: Pfitzner's Music House, Smith Street, Darwin. Tel. 3801

Technical Review

TRANSLATOR STATIONS SERVE ISOLATED AREAS

Elsewhere in this issue (page 59), a list of TV translator stations has been added to the normal TV station list. Some idea of the work entailed in establishing these stations is given in this extract from the 17th Annual Report of the Australian Broadcasting Control Board.

N the Sixteenth Annual Report reference was made to amendments to he Broadcasting and Television Act degned to remove difficulties associated vith the licensing of television translaor stations. As explained in that Report translator station is a relatively low-owered device which relies for s operation on the reception of signals rom a high-powered parent station of nother translator station and the reansmission of those signals on a differnt frequency channel. Translator staons are intended in the main to supply ervice to relatively small concentrations f population which, mainly because of opographical features, are not receiving satisfactory service from the high-owered stations.

The establishment of translator tations so far approved will provide ervice to approximately 106,000 people r about 1 per cent of the population f the Commonwealth. They will also nprove service already provided to some 0,000 people or approximately 0.3 per ent of the population. The provision f these translator stations will thereore represent valuable progress in imroving television coverage; at the same me the figures quoted indicate the mited numbers to which service can be rovided by translator stations. They are ot, as has been previously pointed out, means by which television services an be substantially extended.

The Board's Sixteenth Annual Report eferred to the grant of licences to the Snowy Mountains Hydro-Electric Authority for two translator stations, one t Mount Youngal and one at Twin Peak, to relay the programs of the comnercial television station AMV in the Upper Murray area. These commenced operation at the same time as AMV n September, 1964, and are providing satisfactory service.

Considerable progress has been made on investigations into the possible estabishment of translator stations in addiional areas. In all areas it has been necessary for the Board to make a detailed technical survey to determine the appropriate location for translators and the technical conditions of operation. Basically it is essential that, from the parent station, a signal of good strength and stability is available near the area to be served.

In the case of Lithgow, the receiving and transmitting aerials will be separated by about half a mile; it was not possible to select a single location which would meet requirements for both receiving and transmitting. The receiving and transmitting installations will be connected by an underground co-axial cable with an amplifier located in a pit near the receiving aerial.

In the case of the Lithgow commercial translator station it is proposed to employ a channel 1MC lower in frequency than the normal channel 6 to alleviate possible interference difficulties with reception in the area from the Sydney station Channel 7 (ATN). Although Channel 7 is weak in Lithgow, the Board understands that it is viewed there, and the modified channel 6 will introduce a guard band of 1MC. The use of the alternative channel available for the Lithgow area, Channel 11, was not favoured because of possible interference from the local oscillators of receivers tuned to Channel 7.

The provision of a television service to the west coast of Tasmania presented a difficult technical problem because of the rugged terrain. In an initial survey the possible points at which signals adequate for translator operation might be expected were limited to Mount Owen and Mount Lyell (near Queenstown) and Mount Read near Rosebery. Subsequent investigations quickly eliminated Mount Lyell from consideration as the only signals available there—from Hobart stations—were found to be quite inadequate for translator operation.

Because of the relatively easier access to Mount Read compared with Mount Owen, and the promise shown by a limited series of measurements there, a recording station was set up and signal strength recordings made over a period of some two weeks. Recordings were made of signals from the Launceston station as those from Hobart were very poor. Although useful signals from the Launceston station were observed at times, at other times the signals were very poor and quite unsatisfactory for translator use.

On the other hand, signals on Mount Owen from the Hobart stations were found to be satisfactory, being considerably stronger and steadier than those from Launceston stations on Mount Read. No useful signals from the Launceston stations were observed on Mount Owen. Access to Mount Owen has presented some difficulties, and for the time being has been solved by the licensee of TVT Hobart in association with the Mount Lyell Mining Company by means of a bulldozed track allowing four-wheel-drive vehicles to reach a point 200 yards from the translator site which is somewhat lower than the peak of Mount Owen. From this site service will be provided to Queenstown, Zeehan and Gormanston directly and possibly also Strahan. The translator to be established on Mount Read to relay programs from the station on Mount Owen, will provide service to the majority of the population of Rosebery.

The translators at Mount Owen and Mount Read commenced operation in June and July, 1965, respectively on low power. The Mount Owen translator is operating on a power of five watts and the translator at Mount Read on a power of one watt. The translators will operate on their authorised power as soon as possible. At Mount Owen, as in the case of Lithgow, the transmitting and receiving aerials are to be separated by some distance, and the two sites are to be connected by a cable.

The separation is necessary because signals from TVT of adequate strength could not be received at the site which was satisfactory for transmitting.

The Board is aware that parts of Smithton are shaded from the site for the translator station to serve the Smithton-Stanley area of Tasmania (The Nut, near Stanley) by Tier Hill in Smithton, and in the event of service in parts of Smithton being unsatisfactory, a further low power translator station may be necessary on Tier Hill relaying programs from the Stanley translators. Before determining The Nut as the site, the Board gave consideration to the location of translators at Tier Hill and sites further south, instead of on The Nut. However, investigation showed that the signals on alternative sites were much weaker than those at The Nut and were insufficiently strong for translation. ▫

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FERRITE BEADS PROTECT DETONATORS FROM RF

The risk of premature detonation of explosive charges by RF energy from radio transmitters is a very real one. This article from "Electronics", by Stanley M. Adelman Sr., describes the development of attenuators suitable for detonator protection.

"SWITCH off radio transmitters" signs seen at blasting sites are just one protection against the premature firing of a detonator by stray RF radiation. Electroexplosive devices, which can deteriorate under such radiation if they do not actually go off, can be guarded by shields, filters and attenuators. The latter approach works best, but until recently it has been difficult to make the ferrite attenuators that are useful for lower frequencies without greatly increasing the size of the device. Now a joint effort by the Picatinny Arsenal and the Franklin Institute in Philadelphia has produced an assembly technique so successful that Picatinny is incorporating ferrite attenuators in many Army electroexplosive devices.

Both industry and the military have been investigating the problem of keeping RF signals away from detonators. Industry uses the devices in excavation and demolition work, in seismic research and metal-working, and in oil drilling. The military puts them in everything from blasting caps to ICBMs —and the missile men use the devices at launch sites surrounded by radars that are powerful sources of radio-frequency radiation.

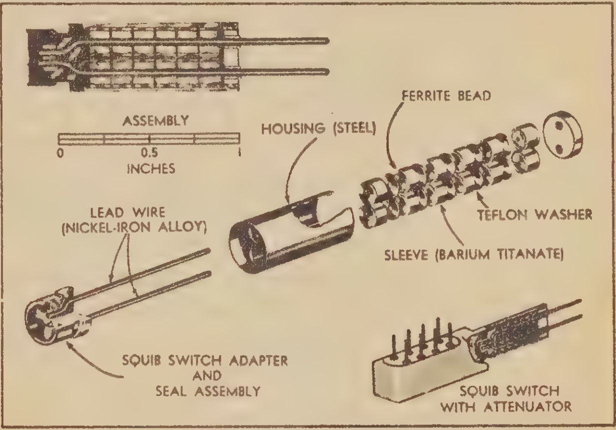
The best way to overcome the spurious radiation is to absorb the RF energy as it passes through the lead wires of the detonator, without affecting the firing current. An attenuator can be substituted for the usual plastic plug through which the lead wires pass.

The first material successfully used as an RF attenuator for electroexplosive devices was powdered iron, coated with iron phosphate. The material was compressed into a plug and then directly substituted for the end plug in the T24E1, one of the smallest detonators in the armament inventory. When subjected to performance, stability and environmental tests, the device kept the same detonating characteristics. Larger devices were also tested with powdered iron plugs and comparable results were obtained.

For typical powdered iron plugs, the higher the frequency the greater the attenuation. However, the powdered iron plug cannot provide protection below 50MC unless the device is made bigger. Also, this method does not have good voltage breakdown or insulation resistance characteristics.

For some time, ferrites have been considered a likely source of RF attenuating materials, especially at the lower frequencies. (Electronics, May 17, p. 65.) Tests have been conducted to determine performance characteristics of carbonyl iron and a typical ferrite (manganese-zinc). Ferrites have proved to be more suitable than iron for RF attenuators, at both low and high frequencies.

But ferrites do present a problem of assembly. Powdered iron is readily moulded over the lead wires, and wire breakage is rare even though extremely high pressures are required during the assembly process. The same assembly technique cannot be used for ferrites because the high curing temperatures required can melt most lead wires.


ASSEMBLY
0
0.5
1
INCHES
FERRITE BEAD
HOUSING (STEEL)
TEFLON WASHER
SLEEVE (BARIUM TITANATE)
LEAD WIRE (NICKEL-IRON ALLOY)
SQUIB SWITCH ADAPTER AND SEAL ASSEMBLY
SQUIB SWITCH WITH ATTENUATOR

Stacked ferrite beads with Teflon washer separators attenuate RF before it penetrates squib switches. It is hoped, ultimately, to provide adequate protection down to 100KC.

The Picatinny-Franklin Institute method calls for the use of ferrite beads about 0.1 inch long and 0.1 inch in diameter, each having an annular cavity slightly larger in diameter than the lead wire. These beads are silver-plated and fired at 1,200-1,400°C. They are slipped inside a lead zirconate or barium titanate ceramic sleeve that has also been silver-plated and fired, and bonded to the ceramic with a conductive silver-filled epoxy cement. The electric lead-in wires are bonded in turn to the assemblies with a conductive silver-filled cement. A thin Teflon washer is placed between each assembly.

The entire assembly — the electrical conductor, ferrite beads, and ceramic insulators and washers—forms one lead for the detonator. Two such assemblies are placed into the attenuator body, which is also of conductive material. During the curing process a special fixture exerts pressure on the end beads. This prevents the epoxy from leaking and short-circuiting the attenuator. The diagram shows a ferrite device designed to protect squib switches.

This type of attenuator is now being designed for use with explosive switches of the type used in many missiles. A typical mechanical configuration allows one inch of space for the attenuator. The amount of ferrite used here results in 17dB of attenuation at 10MC and about 1.8dB of attenuation at 1MC. Larger devices, 3 inches long and ¾ inch in diameter, have resulted in 70dB of attenuation at 10MC and 10dB at 1MC.

Improved application techniques should eventually make possible adequate RF protection down to about 100KC. ▬

Background

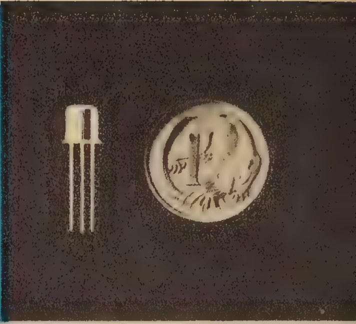
An electroexplosive device is a highly concentrated source of energy which is fired by an electrical signal. In its simplest form, the device consists of a firing circuit, a power source, bridgewire (or resistance), lead wires and explosive charges. The electroexplosive is fired when current passing through the bridgewire heats it, and causes a thin film of heat-sensitive explosive wrapped around the bridgewire to be raised to ignition temperature. When this explosive, the spot charge, detonates, a shock is generated that ignites a less sensitive priming charge, which in turn fires the base charge.

When a continuous source of RF radiation encounters the lead wires or associated circuitry of an electroexplosive device, current is induced which passes through the circuit and eventually through the bridgewire. The current level is related to the intensity of radiation, the efficiency of the antenna structure (represented by the lead wires and circuits), the impedance match between the antenna and load, and the reflective or aborptive losses. If the frequency of the RF radiation is one to which the antenna structures responds efficiently, and the intensity of the radiation is high enough to overcome losses in the circuit and still approximate the firing requirement for the electroexplosive device, the consequence may be loss of life or property damage, or both.

If the current remains below the firing level, but is applied for some time, desensitization of the spot charge or changes in the bridgewire may take place, and the device will become unreliable. Detonators which fail to fire not only result in expensive time delays, but also increase the danger to personnel, since they must be removed and replaced.

Pulsed radar signals may also be a hazard even if the current induced is well below the danger level. The heat generated during the pulse cannot be entirely dissipated in the time between pulses. Thermal stacking can cause the charge to be either desensitized or fired.

NEW SILICON TRANSISTORS FROM Mullard



A new range of silicon planar transistors is now available from Mullard with a wide application in the entertainment, industrial and professional fields.

- **Low Cost**
- **Improved signal handling capability**
- **Good noise performance**
- **Excellent AGC characteristic**
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T0-18 encapsulation offers the following advantages—

- **a metal can and glass header which provide complete sealing against moisture penetration**
- **low inter-electrode capacitances resulting in higher available gain for a given set of parameters**
- **very low leakage current maintained over normal life, particularly at elevated temperatures**

Type Number	Description	V_{CBO} (V)	V_{EBO} (V)	I_C (mA)	P_{tot} (mW)	f_T (Mc/s)	h_{FE}
BF115	n-p-n RF silicon planar epitaxial transistor	50	5	30	140	230	45 to 165
BC107	n-p-n AF silicon planar epitaxial transistor	45	5	50	300	85	125 to 500
BC108	n-p-n AF silicon planar epitaxial transistor	20	5	50	300	85	125 to 500
BC109	n-p-n low-noise AF silicon planar epitaxial transistor	20	5	50	300	95	240 to 900

Mullard silicon planar transistors are designed so that each gives optimum performance for a particular application, such as RF or AF amplifiers. The BF115, for example, is designed as an AGC controlled RF amplifier, its low value of feedback capacitance providing high gain; and low knee voltage (less than 1V at 10mA) enabling a large voltage swing to be achieved in IF stages.

More detailed information on these transistors may be obtained from the Mullard Technical Service Departments at the addresses below.

Mullard

MULLARD-AUSTRALIA PTY. LTD. ● 35-43 CLARENCE STREET, SYDNEY, N.S.W., 29 2006.
123 VICTORIA PARADE, COLLINGWOOD, N.5, VIC., 41 6644
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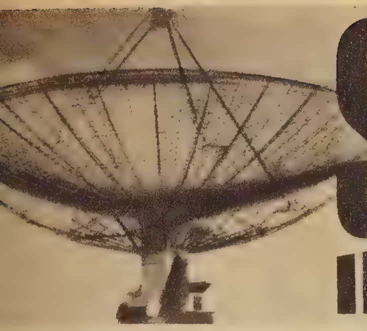
M17



SCIENTIFIC AND INDUSTRIAL NEWS

ire Alarm

An inexpensive, hand-operated fire-alarm, simple to operate nd effective in providing adequate warning over a wide area an emergency, has been developed by a British firm. It omplies with fire prevention regulations applied to factories, ffices, shops and railway premises.

Known as the Bromco Fire Alarm, the device is constructed rom high-grade aluminium and its operation is completely ndependent of any source of power supply. The alarm is perated by rotating the handle of the instrument. A steel nocker then strikes rapidly and continuously against the luminium dome and its loud warning note enables it to be eard over a wide area and above normal factory and workshop oises. A number of units would be required to provide adequate rotection in large buildings. (Industrial Trucks Limited, Cord Vallis Estate, Maidenhead, Berkshire, England.)

Milling Boring Machines

Among new British machines shown at the European Machine Tool Exhibition in Brussels was a horizontal milling, oring and surfacing machine with point to point positioning perated from a Ferranti system of numerical control. It has a feet wide patented bed, completely covered slideways, and its wn crane for lifting heavy tools.

The machine, known as the model 724P, is one of three hipped to the exhibition by H.W. Kearns and Co., of Broadheath, ltrincham, Cheshire. Its work table will rotate through 360 legrees and both main feed and auxiliary controls are operated rom a pendant which has rotary switches for operating magnetic lutches. Through the latter, the appropriate vertical traverse is btained. Also included in the pendant control are switches for ngaging hydraulic clamping for all traverses and the "start" stop" "reverse" and "inching" buttons.

The second machine shown by Kearns was also a horizontal orer and miller: the series 45 with optical and automatic bar etting systems. Main features claimed are rapid indexing of ne work table, quick tool changing facilities and the ability o position quickly and accurately with a simple form of utomatic setting.

It has a two feet by two feet work table and tool changing operated hydraulically from a two-way switch on a console vhich also houses the controls for automatic hydraulic clamping o the transverse and vertical traverses. Feeds to the main raverse motions are infinitely variable from .015 inch to 100 nches per minute.

Particularly useful for batch production, the machine still as the virtue of speed and continuity — once the stops have een set on the automatic bar setting system the machine can roduce any number of components. The bars are designed so hat they may be removed from the machine and set independently n the tool room.

A third machine shown was a planer table type horiontal milling, boring and surfacing machine known as the 451P. t has an automatic built-in facing chuck and a travelling pindle. Said to be particularly suitable for the manufacture f jigs and frames, printing and textile machinery components s well as general engineering work, the machine has a three eet by six feet main table and a two feet six inch by two eet six inch revolving table. It is fitted with a Philips numerical ositioning system.

Europe's Highest Antenna

The final stage in the construction of the tallest structure n Europe has now been reached, says "Radar and Electronics Quarterly." Steel sections have been hoisted right to the top f the new 1,265-foot high cylindrical television mast at Emley Moor, near Huddersfield, Yorkshire. The mast is one of three being built to a new design for the Independent Television Authority. The other two are at Winter Hill (Lancs.) and Belmont (Lincs.). The mast at Belmont will also be 1,265 feet tall, but the one at Winter Hill has already reached its full height of 1,015 feet.

These masts set the pattern for a new generation of aerial supporting structures by departing from the open lattice type of stayed mast generally used in the U.K. The new design employs curved high tensile steel segments to form a nine-foot diameter cylinder for the mast column which rises at Emley Moor to 900 feet. A 350-foot lattice section on top together with the capping cylinder brings the total height to 1,265 feet.

The lattice portion, together with the upper part of the cylindrical steel section, is designed to carry five aerials capable of transmitting nine programs.

This form of mast offers many advantages in addition to being able to support extra equipment without adding to the wind loading. Entry is at ground level through the 10-foot high reinforced concrete superstructure on which the cylinder stands. Access to all parts of the structure from within is possible in the worst weather. All joints in the cylinder are weather-proofed with sealing compound when they are bolted together and this gives complete protection to the aerial feeders and ancillary equipment within. Even the UHF and VHF aerial sections at the top will be enclosed in a glass-fibre shroud to maintain the cylindrical form and permit maintenance to be carried out in all weathers. The obstruction lights are hinged so that they can be swung inside for servicing. Maintenance men have the benefit of a lift in the cylindrical portion, travelling at about 100 feet per minute. Beyond that there is a hoist for carrying materials to the summit.

Pulse Duration Controller

A new solid-state pulse duration controller has been announced by The Foxboro Company, Foxboro, Mass. This instrument may be used with a reversible electric motor to drive a control valve, damper, or rheostat.

This operator in an electronics factory at Lincoln, England, is using the latest type of high-speed assembly equipment to produce silicon planar transistors. Parts smaller than a pin-head are assembled with the aid of a stereo microscope fitted with zoom lens. (Associated Electrical Industries Ltd., Electronics Group, New Park, Leicester, England.)

KEW METERS

VOLT-OHM-MILLIAMMETER K-140

The KEW 140 is a smartly styled Multitester which is equipped with an unusual number of ranges—23 in all—covering 5mV to 5000 Volts DC, 0.1 to 5000 volts AC, luA to 10 amps. DC and 0.2 ohms to 20 megohms resistance. The use of printed circuits and solid construction ensures reliability while the clear 6in scale ensures ease of reading.

SPECIFICATIONS

DC Volts:	**0-0.25-1-2.5-10-50-250-1000-5000V.**
Input R:	**20,000 ohms. Load 50uA F.S.D.**
Accuracy:	**Better than ±3% F.S.D.**
DC Current:	**0-50uA-1mA-10mA-100mA-500mA-10A.**
Accuracy:	**Better than ±3% F.S.D.**
AC Volts:	**0-2.5V-10V-50V-250V-1000V-5000V.**
Input R:	**5000 ohms. Load 200uA F.S.D.**
Accuracy:	**Better than ±4% F.S.D.**
Resistance:	**0-2K-200K-20megs.**
Battery:	**7.5V.**
Decibels:	**-20/+10,-8/+22, +6/+36,+20/+50.**
Frequency:	**10c/s-100Kc (2.5V, 10V and 50V).**
Response:	**Error ±0.5db F.S.D.**
Size:	**7½" x 6¾" x 4⅛".**
Weight:	**3.3 pounds.**

PRICE: £21 Plus Tax 12½ p.c.
FIS Capital Cities all States.

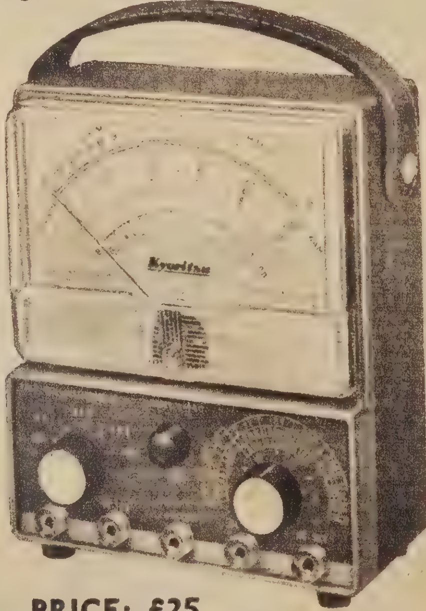
VACUUM TUBE VOLTMETER K-142

The K-142 is a versatile mains-operated VTVM housed in an attractive plastic cabinet with a clear front and a large easy-to-read scale. The K-142 has no fewer than 28 ranges of current, voltage and resistance readings in addition to a db scale.

The weight and size of the K-142 make it ideal for field use as well as laboratory and service work.

SPECIFICATIONS

DC Voltage:	**0-1.5-5-15-50-150-500-1500V (15 or 30 KV Special Probe).**
AC Volts:	**RMS: 0-1.5-5-15-50-150-500-1500V. Peak-peak: 0-4-14-40-140-400-1400-4000V**
Resistance:	**0-1-10-100-1000 Kohms, 0-10-100-1000 Megohms**
Accuracy:	**DCV-3%: ACV-5%: Ohms within 3% total scale length**
Decibels:	**-20 to +65 db**
Zero Centre:	**For adjusting FM detectors**
Response:	**±3%: -50c/s-500Kc/s: ±5%: -30c/s-1.5Mc/s: ±10%: 15c/s-10Mc/s**
Input R:	**DCV 11 Meg (1 Meg in probe)**
Size:	**7½" x 6¾" x 4⅛"**
Weight:	**4.5 lbs.**



PRICE: £25 Plus Tax 12½ p.c.
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SCIENTIFIC NEWS — cont.

The pulse duration controller is suited for any number of applications requiring automatic flow control or fast-acting pressure control. In steel, cement, and non-ferrous metals production, for example, the controller may be applied to regulate flows on reheat furnaces, reverbatory furnaces, air and flue gas systems, wherever reversible electric motors are used to drive large dampers and valves. It may also be applied to pelletising and sintering operations and ore-water ratio systems.

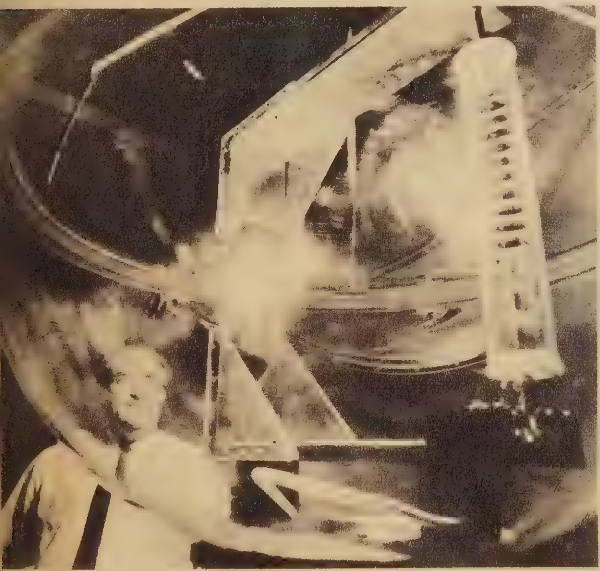
In operation, the controller receives a signal from a transmitter—such as a d/p cell—and compares this measurement with the controller set point. It then produces a series of pulses, the duration of each pulse being proportional to the deviation between measurement and set point. These pulses, in turn, actuate a reversible electric motor operator on a valve or damper in the line to correct the flow rate.

Since the system is electronic, there is no transmission lag. Therefore, the controller can be located in a control room up to several thousand feet from the control valve. Also, the controller is capable of energising most medium-sized electric valve actuators directly without intermediate relays or feed-back slidewires.

Pneumatic Computer System

Electronic switching and amplifying systems are generally regarded as essential for computers, but the British firm of Maxam has introduced a system which uses air instead of electricity to provide the necessary amplification.

The system, called the Maxalog air amplifier, is based on the following principle. Airflow can be smooth or turbulent.



An intricate antenna system is being designed for the Lockheed 2000 supersonic transport aircraft, now under development in U.S.A. Standby antenna systems in duplicate and triplicate will instantly come into operation should any malfunction occur in the communications sensors. One of the antennas designed for the aircraft is seen here undergoing high-altitude tests in a transparent vacuum chamber at the Lockheed Rye Canyon Research Laboratory, California.

Turbulent flow causes less drag—hence the small projections on the wings of jet aircraft to cause turbulence. It is this difference between smooth and turbulent flow that provides amplification. A jet of air, flowing smoothly, is kicked into turbulence by injecting a small and weak air jet at right angles to the main stream. This changes the characteristics and provides a large change for a small input.

This idea, with various ingenious extensions, is used in the Maxalog system. Although relatively slow (operating in thousandths rather than millionths of a second) the system has obvious advantages and could find application in a number of fields.

The forward planning engineer of Maxam's, John Edwards, has said that among the advantages of a pneumatic system over electronics, the fact could be mentioned that it was simple; units could not be damaged by overloading, and had virtually an indefinite life; power consumption was extremely low; maintenance problems were considerably reduced because all could be undertaken by one type of engineer.

Mr Edwards pointed out that they did not advocate trying to build computers from Maxalog turbulence amplifiers, which had their own particular applications in the industrial field. They were considerably lower in cost than the electrical equivalent, and were perfectly safe in environments of very high and fluctuating temperature, high humidity or explosive atmosphere, where electronics systems were inadvisable.

Metal Injection System

A new metal injection system for pressure diecasting machines has been developed by Buhler Brothers, of Uzwil, Switzerland, which, it is claimed, will substantially improve machine utilisation, maintain maximum accuracy of castings and reduce operator hazards.

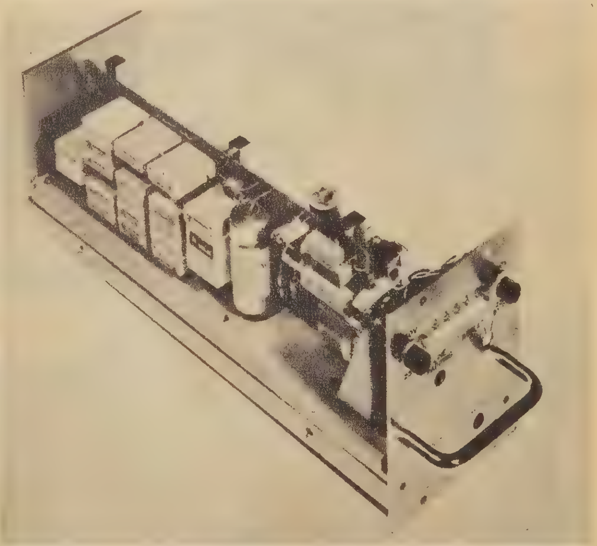
An industrial fan impeller blade casting is being produced in aluminium by the company on a machine of 250 tons locking force which is equipped with the new system. The impeller blade has a total projected area of 115 square inches and a shot weight of 3.35lb. In the system, pressure-tight castings, which normally require a higher specific injection pressure, can now be produced without substantially reducing the maximum projected area, which would be obtainable on a conventional fully hydraulic machine of comparable locking force.

With the Buhler development pressure transients in the shot system are almost completely ironed out, the formation of unwanted flash is eliminated and where the metal is compressed toward the end of a shot it is given a final squeeze.

Nuclear Power Desalts Water

The world-wide desalting of water by means of nuclear energy has been brought a step nearer by recent tests in Israel and California. United States Government officials stated that the tests (with the Metropolitan Water District of Southern California and the Government of Israel) had proved "the economy and the feasibility of using nuclear power to desalinate water." A nuclear desalination plant could be in full operation in California by 1970 or 1971.

The Atomic Energy Commissioner, James T. Ramsey, underlining President Johnson's interest in the program internationally as well as domestically, said that as a result of the President's endorsement of a nuclear desalination program to the International Atomic Energy Agency there had been a growing exchange of information on the subject among interested nations.

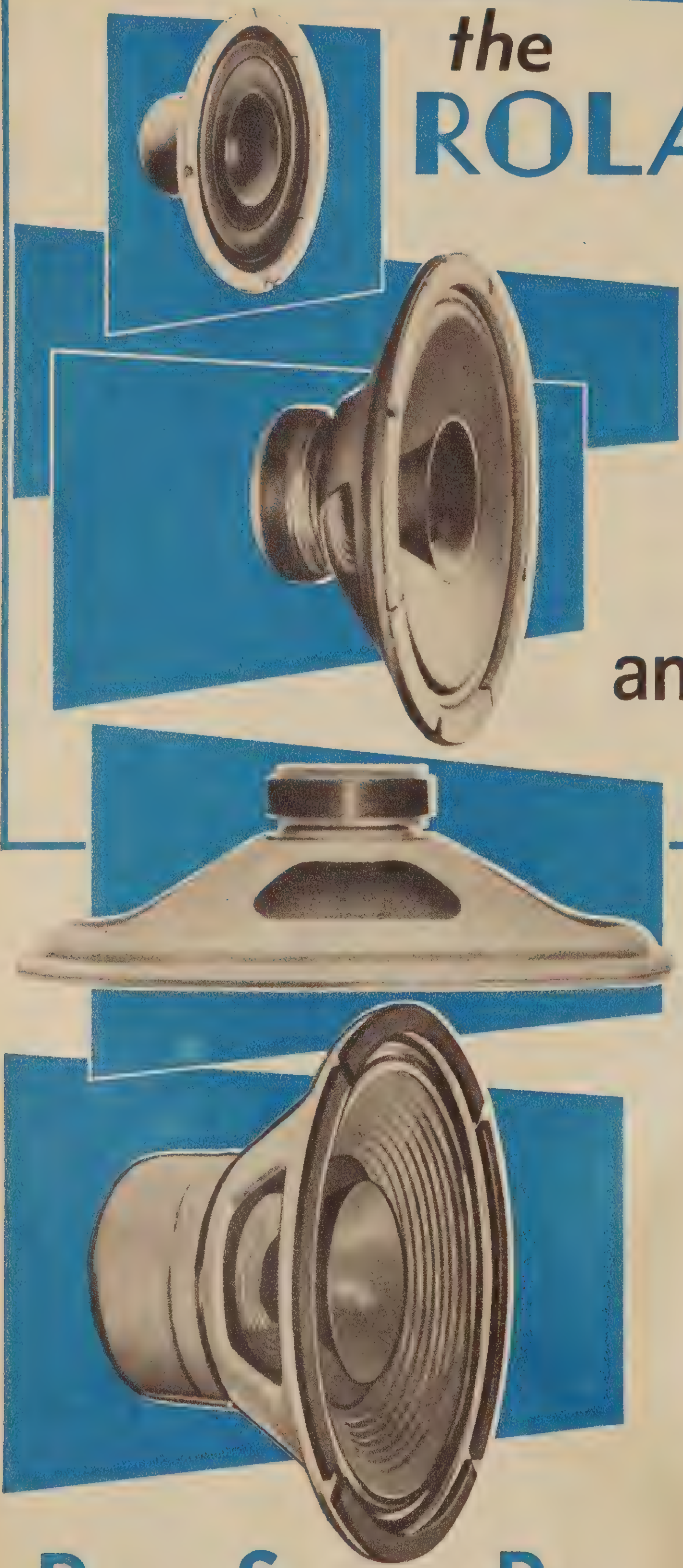


A regenerative telegraph repeater which will correct errors in signals transmitted by undersea cables or radio circuits has been developed by Amalgamated Wireless (Australasia) Ltd. The Overseas Telecommunications Commission (Australia) and Cable and Wireless (London) have ordered a total of 170 of the new repeaters for use on the SEACOM cable. The picture shows one of the repeaters with cover removed. Databloc logic modules used in the repeaters can be seen at left.

Special Qualities of New Graphite

A new grade of graphite (grade KJB) with only one-fiftieth the thermal conductivity of conventional graphites has been developed by Union Carbide's Carbon Products Division. Intended primarily as a load-bearing thermal insulation for industrial equipment such as boilers, heat exchangers, and hot pipe lines, the material has a compressive strength of 9,000psi, compared with 50 to 200psi strength of most thermal insulation. It has a coefficient of friction of 0.20 and the ease of machinability of conventional graphite, claims Union Carbide.

The K factor, or measure of thermal conductivity, for the



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of Wide-Range Loudspeakers with its choice of five twin-cone types and two 2-speaker combinations having Top Frequency Responses ranging from 10 to 16 kc. and Power Ratings from 7 to 30 Watts offers performance standards and a versatility of application which makes it

an unbeatable combination

The Rola Wide Range series comprises the Dual Cone Models C9-6LX, C8MX, C12MX, 12PX and 12UX, the 5FX Tweeter and the 12PEG and 12UEG Bass speakers.

Brief technical details are as follows:

MODEL	FREQUENCY RESPONSE c.p.s.	PEAK POWER RATING
C9-6LX	85-10,000	7
C8MX	40-12,000	16
C12MX	45-10,000	10
12PX	45-12,000	20
12UX.	40-14,000	30
5FX	4,000-16,000	30
12PEG*	35-16,000	20
12UEG*	35-16,000	30

* In combination with 5FX Tweeter.

Dimensions: C9-6LX is a 9" x 6" elliptical, 5FX a 5" round, C8MX an 8" round and the others 12" round. Full specifications are to be found in the Rola Technical Bulletin No. 24 which is available on request.

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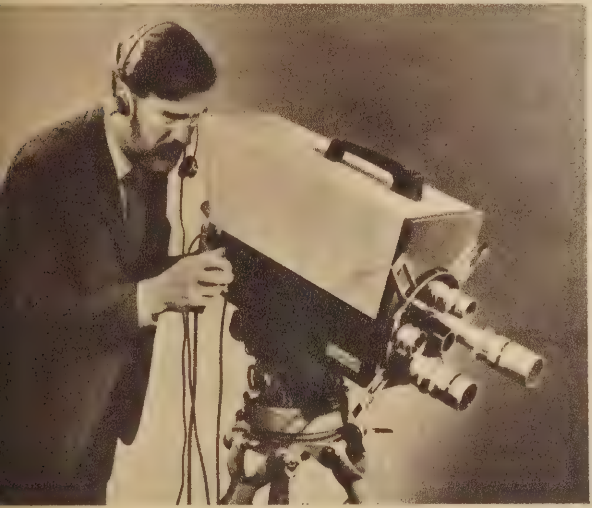
new graphite is 2 as contrasted to a figure of 86 for conventional graphite and 26 for steel. Thus the new grade of graphite combines the desirable graphite properties of machinability and ubricity with the desirable carbon properties of high strength and low thermal conductivity.

Soldering With Infra-Red

Infra-red heat concentrated by a rounded reflector is being used to solder glass-metal composite parts without breaking the glass. The Lead Industries Association of 292 Madison Avenue, New York 17, says, "the mechanism of infra-red absorption s such that heat is generated deep within the glass and at he surface of the metal, thus the entire joint heats at a nearly uniform rate, reducing the possibility of glass cracks."



This fully transistorised TV camera has been developed by The Marconi Company, England, for educational closed-circuit television. Features of the design include extremely simple operation and automatic circuitry which will maintain a stable picture and cope with changes in light level as great as 2000:1. The version seen here has high-brightness viewfinder and manually operated four-lens turret.

The association also says that this method solders the part at the lowest possible temperature, about 430 degrees F. This is 125 degrees cooler than a soldering iron would need. The method also eliminates the possibility of contaminating the solder with the tip of the iron.

Waterproof Seals

British Insulated Callender's Cables in U.K. is marketing a type of "putty," called Bicaseal, which can be used for sealing, repairing, jointing and waterproofing a variety of materials, including metal, wood, glass, ceramics and some plastics.

It consists of a two-part mix of resin and hardener, the two constituents being supplied in the form of sticks. When the two materials are mixed, the mixture immediately begins to set, and in 1½ hours is hard enough for most practical purposes, under normal working temperatures. It will also set under water.

The new material will be available soon in Australia from Cablemakers (A.C.T.) Pty. Ltd., 110 Swanson Street, Erskineville, N.S.W.

Silavan Polymers

Development of a new group of polymers is claimed by the Institute of Chemistry of the Academy of Sciences of the Latvian S.S.R. They are called silavans and contain silicon, carbon and nitrogen.

They are colourless resins with a high melting point, able to resist caustic chemicals, and soluble in organic liquids. Very strong thin films can be produced from these silavans and they work well as protective materials on the surfaces of metals.

New Cleaning Solvent

A new cleaning solvent with no flashpoint and extremely low toxicity is proving useful to the electronics industry. Some manufacturers are using it to clean printed circuits and tiny components.

The solvent is an inhibited 1,1,1-trichloroethane, and is marketed under the trade name Clorothene NU by Dow Chemical (Australia) Pty. Ltd. It is said to have the advantages of petroleum-based and chlorinated solvents, but without the attendant disadvantages possessed by these materials. Petroleum-based solvents have comparatively low toxicity, but present a high fire hazard. Chlorinated solvents, such as carbon tetrachloride, have no fire hazard, but are relatively high in toxicity.

U.K. Government Supports Automation

Britain's Minister for Technology has approved a scheme under which the National Research Development Corporation will give financial support to pioneering automation projects in industry. Arrangements have been made with one of Britain's leading manufacturers of automation equipment, Elliot-Automation, to give financial assistance for about 20-30 projects.

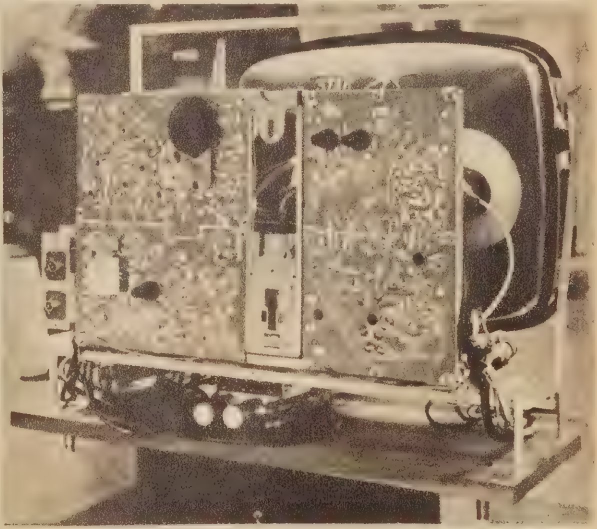
The object of the scheme is to spread the cost of development of automation systems, to minimise the burden of cost which tends to fall on the first organisation to install a new type of automation system.

A Sideways Look for Drivers

Drivers of vehicles with long bonnets are likely to appreciate a wing mirror being produced by the Sawar Industry Company, 99 1-chome Nakajima-machi, Nakamura-ku, Nagoya City, Japan. The rectangular box-shaped mirror has a lens on each end and these relay the view through a central mirror facing the driver. The side lenses give an angle of vision of 35 degrees and are claimed to be very useful on blind corners.

Cutting Brittle Material

Thick and brittle plastic sheet and hard resinous papers are easily cut without tearing or splintering, it is claimed, by a simple device designed by Hans Kolbe and Co., Heinrich Schlangestr. 1, Bad Salzdetfurth, Germany. The sheet or strip of material is moved between an upper and a lower rotary cutting tool, which rotate at the same speed but in opposite directions. The material can be pushed or drawn between the cutting tools or, alternatively, the tool can be made to move along a cutting line and the material kept stationary.



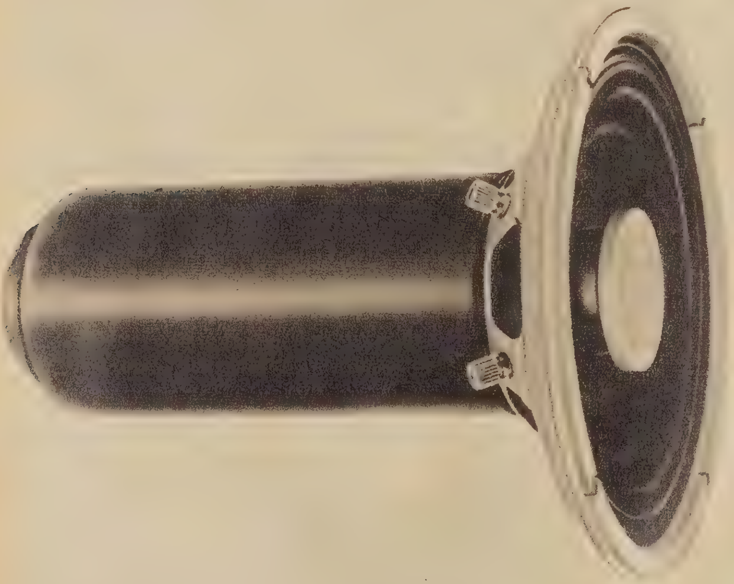
This EKCO 19in TV receiver was exhibited at a recent Radio and Electronics Components Exhibition in London to show how the use of printed circuit boards enabled the designer to reduce the cabinet depth. Special qualities claimed for the material used (Formica industrial laminate DCC 20) include good electrical and punching properties, and exceptional resistance to "tracking," i.e., the formation of a carbonised conducting path across the laminate after etching.

Ceramic Parts

Ceramic parts are floated through a kiln on a cushion of burning gas in a system developed by the Norton Company, of 1 New Bond Street, Worcester 6, Mass., U.S.A. The gas, in addition to supporting and moving the green pressings, also fires them to the requisite hardness.

Gas and air are mixed in a pressure chamber below the porous ceramic plate which forms the bottom of the kiln. Under pressure, the gas passes through the ceramic plate and lifts the pressing. At the same time it burns to heat the kiln.

RB-11A
A reverberation amplifier with integral 6½" speaker, housed in oiled wood case. Delay time 1.8 sec. Frequency range 80/9000 c/s. Maximum output 3.5W. Size only 8" x 12" x 7".



20-RE
A patented reverberation speaker for adding to existing installations. Delay time 1.7 sec. Frequency range 60/15000 c/s. Maximum output 12W. Diameter 8¼" x 10" long. Impedance 8 ohm.

EA-106
The essential device only — for those who wish to build their own reverberation unit. Delay time 1.8 sec.

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New Computer System

A new concept in computer operation, whereby engineers can obtain instantaneous solutions to aircraft design problems, is now used by the Lockheed Georgia Co. in the U.S.A. Communications terminals throughout the plant, which connect directly to a central computer, are available to design engineers.

An easily learned mathematical computer language, called "Fortran IV," is used by engineers to communicate with the computer. This eliminates delays previously caused by the necessity to discuss problems with a mathematician prior to having them programmed for computer solution. The system has been developed by IBM.

Silicone Rubber Foam

A novel silicone rubber foam, RTV-7, which foams instantly and cures in three to four minutes, is available from International General Electric Company of New York. The material is supplied as a black liquid, and addition of a curing agent makes it foam and cure at room temperature. It can therefore be formed on the spot to give mechanical support, and can be formed under water, thus suggesting an instantly made buoyancy support for sunken objects. The new product can be used at temperatures down to 65 degrees F and up to 600 degrees F.

Electric Fence Development

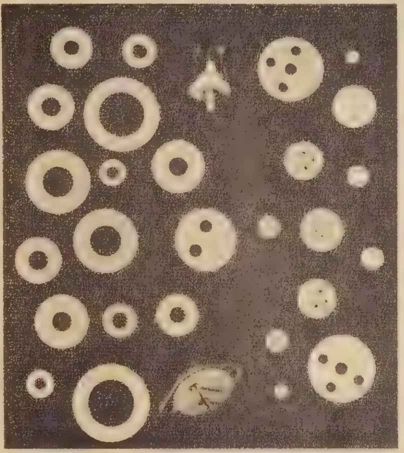
An electric fence control unit which, it is claimed, feeds power efficiently over very long distances under poor insulating conditions, has been developed in New Zealand for local and overseas sales.

The manufacturers say the Waitkato controller will feed power effectively through 35 miles of well-insulated fencing, 15 miles of average electric fencing and up to a mile of badly insulated wire. Four years of field tests are said to have proved the controller to be effective in a wide variety of applications—from keeping stock penned in on sheep and cattle stations to keeping wild pigs, possums and even rats out of lowland crops.

The Postmaster-General's Dept. has placed an order worth £625,000 with Associated Automation, London, for a new type of electronic telephone coin box of the type illustrated here. The box sends electronic signals to the exchange, which enable the operator, or an automatic device, to register the value of coins inserted by a caller. The unit also sends signals which, the makers claim, prevent fraudulent misuse of the phone.

Removing Rough Edges

Metal parts of many shapes and sizes can be given a variety of finishing treatments in the latest vibratory deburring machine marketed by Roto-Finish, Mark Road, Hemel Hempstead, Herts., England. Suitable for batch production or continuous operation, it can be used for the polishing, descaling, deflashing and ball burnishing of die castings, stampings and machined components. The machine's processing tub, its equipment for separating the processing media from the components being treated, and its media return conveyor and liquid compound recirculation systems are all contained within the one unit. The operator controls the machine from a separate console.



A representative selection from the wide range of boron nitride semiconductor mounting wafers made by Union Carbide in U.S.A. The special properties of boron nitride allow it to act as an electrical insulator while at the same time conducting heat to the chassis, which acts as a heat-sink.

Two-Tier Garages

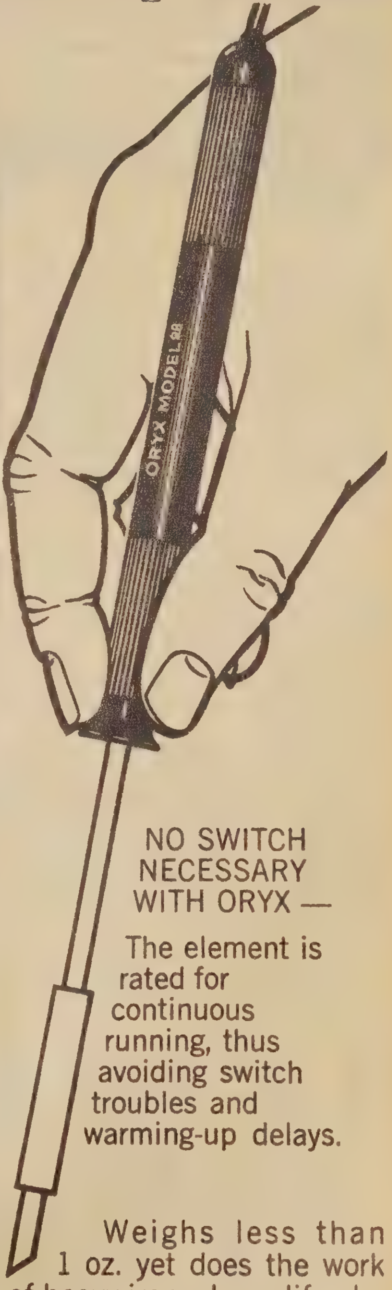
Salzgitter Stahlbau G.m.b.H., of Salzgitter-Watenstadt, Germany, manufactures a motor-driven platform which can be built into an existing single-car garage so that two cars can be housed, one above the other.

The roof of the existing garage is removed and the steel unit laid in position where the roof joints were originally. The brick walls of the garage are then built up to make the garage "two-storey" and the roof replaced. The upper berth has a retractable steel ramp which slides under the upper platform when not in use.

Descaling Metal

A very quick process for descaling metal plate, wire and sheet, and also suitable for the inside of tubes, is reported by Noburo Sasaki, The Coal Research Institute, 1 1-chome, Odasakae-cho, Kawasaki-shi, Japan. In a bath containing a conventional pickling agent, ultrasonic waves produced by a transducer rapidly disperse the hydrogen bubbles produced on the component's surface by the pickling agent. Polishing after pickling is not necessary.

ORYX
World-famous miniature Soldering Instruments



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The element is rated for continuous running, thus avoiding switch troubles and warming-up delays.

Weighs less than 1 oz. yet does the work of heavy irons. Long-life element and replaceable bits ensure years of service. There's an ORYX designed to meet your precise requirements.

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A RADIO CONTROL SYSTEM FOR MODELLERS — 2

The radio control receiver, actual size. It is housed in a light-weight aluminium box.

Last month we described the construction of a transmitter for radio control operating in the 27MC control band. This month we describe the companion receiver for this unit. Small enough to fit into most models, this receiver, when used in conjunction with the transmitter mentioned above, is capable of excellent results over distances of up to a quarter of a mile, depending on prevailing conditions. For the young, and not so young, this simple radio control equipment promises untold hours of pleasure.

For prospective constructors of this receiver we do strongly suggest that either the transmitter described last month, or a similar transmitter, be constructed before the receiver. The reason for this piece of advice is that it is necessary to have access to a transmitter to make the final adjustments to the receiver.

For radio controlled models it is usually necessary to have a receiver which is both physically small and light in weight. By the time that control equipment, batteries and motor have been stowed in a model, there is not much room left for the receiver. In the case of model aircraft the weight problem is important both in respect to the lifting power required and the trim of the aircraft.

While the trend today is towards transistorised superheterodyne receivers, there is still a big demand for simple (normally super-regenerative) receivers with their small size, light weight and lack of complexity.

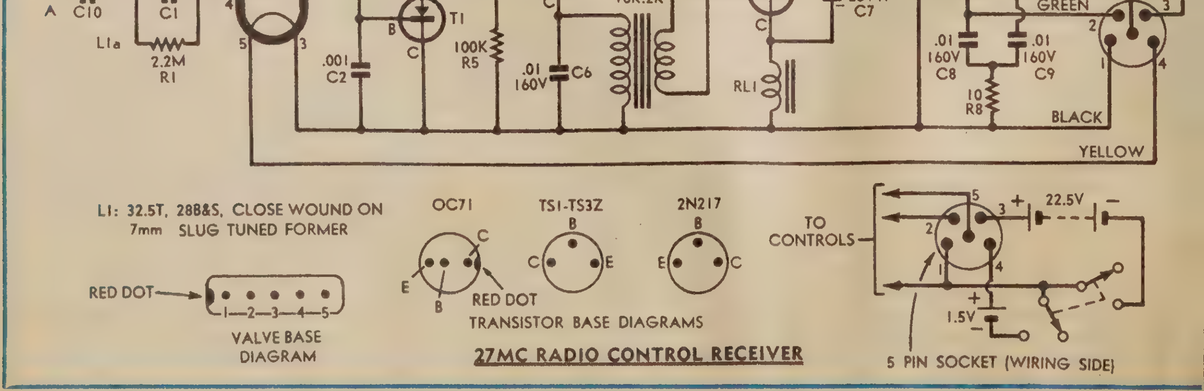
The receiver described, like last month's transmitter, is available from Silvertone Electronics and agents as a basic kit, to which a few standard parts have to be added. This equipment has been marketed for sometime as a ready-built unit and has the advantage of being thoroughly field tested. In th circumstances the constructor is benefi ing from extensive professional exper ence when he builds this kit.

In brief, the receiver consists of super-regenerative detector, a two-stag transistorised audio amplifier and transistorised relay gate.

The super-regenerative detector is th heart of this—and most other—simp VHF receivers, providing good sensit vity with a minimum of componen and circuit complexity. Its sensitivit results from the use of an alternatin quenching voltage (usually in the rang between 20 and 200KC) to interru the normal oscillation of a regenerativ detector; the feedback can be increase far beyond the amount usable in straight regenerative circuit, with a co sequent increase in gain.

The scheme is not without di advantages, however, which include wi bandwidth (poor selectivity) and seve radiation at the received frequenc These two characteristics make it impo sible to use two such receivers simultan ously in the same flying area, sin mutual interference will take place, ea appearing to the other as a transmitte

Circuit diagram of the receiver pictured above. Details of the associated transmitter appeared in the last issue.


XFY34
3xOC71,TS1,TS3Z,2N217,etc.
.01
C3
RED
RFC1
22K
R2
10K
R3
10K
R4
4.7K
R6
C5
5
25VW
47-270Ω
R7
(SEE TEXT)
L1b
L1
L1a
1pF
C10
A
47pF
C1
2.2M
R1
.001
C2
5
25VW
C4
T1
T2
T3
100K
R5
.01
160V
C6
10K:2K
5
25VW
C7
RL1
5 PIN PLUG
BLUE
GREEN
.01
160V
C8
.01
160V
C9
10
R8
BLACK
YELLOW
L1: 32.5T, 28B&S, CLOSE WOUND ON 7mm SLUG TUNED FORMER
RED DOT
VALVE BASE DIAGRAM
OC71
TS1-TS3Z
2N217
RED DOT
TRANSISTOR BASE DIAGRAMS
27MC RADIO CONTROL RECEIVER
TO CONTROLS
22.5V
1.5V
5 PIN SOCKET (WIRING SIDE)

This explains the ruling by Model Aeroplane Clubs that solo flights only are allowed with models using super-regenerative type receivers.

The detector in this little receiver generates its own quenching voltage, as compared to some circuits which use a separate quench voltage oscillator. The quench frequency of the detector is governed by the values of the grid resistor and capacitor. Increasing the value of the grid resistor decreases the quench frequency.

When receiving the control transmitter, the audio tone from the transmitter appears at the plate of the detector, as also does the R.F. carrier and quench frequencies. The R.F. and quench frequencies are filtered out of the input to the first audio amplifier by the R.F. choke and the two capacitors in the base circuit of the first transistor.

The first transistor is wired as a directly coupled emitter follower, which presents a medium impedance to the super-regenerative detector. (The emitter-follower or "common collector" amplifier exhibits a relatively high input impedance and a low output impedance).

The following audio stage is connected as a "common emitter" amplifier and, as such, has a low input impedance and a high output impedance. Thus the coupling between the detector and first audio as well as the coupling between the two transistors is optimised.

The output of the second audio transistor is transformer coupled to the transistorised relay gate. The capacitor across the primary of this transformer resonates it to approximately 500 cps and thus acts as an audio filter giving maximum energy transfer for the audio tone received from the control transmitter.

Readers will recall that last month we mentioned the adjustment of the transmitter modulator to give a 500cps tone. The figure of 500cps is not critical as long as both transmitter and receiver are adjusted to a similar frequency.

By Keith Woodward

The final transistor in the receiver is biased near cut-off and, in the absence of signal, the relay remains inoperative due to the very low standing current. When audio tone is applied, the transistor will conduct during the negative half-cycles which are averaged out or smoothed by the 5uF capacitor between the collector and emitter, the increased current flow serving to operate the relay.

Operation of the relay activates a set of changeover contacts, normally used to energise a control circuit. At this point we must stop, however, since the techniques and mechanisms for model control are beyond the scope of this article.

For setting up the receiver and in normal use the aerial should be about 32 inches in length. Use of an aerial much longer than this is not recommended, since loading on the super-regenerative detector may be excessive, causing unreliable operation. This length of aerial should be sufficient for most applications, however, when used in conjunction with the companion transmitter described last month. In any case, there is a practical limit to the length of

RADIO CONTROL SYSTEM IN ACTION

All four feet off the ground, the winning horse has been caught in the middle of the stride that carried it past the post. The radio link which triggered the camera for this dramatic picture was the type of unit featured in this article.

During our current work with radio control systems, we were able to co-operate in a rather novel application of the system with David Cumming, staff photographer on the national weekly PIX, published by our parent company.

For some of his work, David uses a high-class 35mm camera which itself would be the envy of most photographic enthusiasts. In the interests of versatility, the camera has been fitted with a small electric motor, which can operate it so as to take single frames or a sequence of frames at the push of a button at the end of a control line. The camera has also been provided with a sealed plastic case, which will protect it from the weather and even allow it to be used underwater, if necessary. The proposition which David put to us was that of operating the camera by radio control in those situations where a control line would not be practicable or permissible. The job was ultimately done using equipment as described in this and the preceding article.

Investigation showed that the existing relay in the receiver could be arranged to operate the motor circuit in the camera to take a sequence of frames. The equipment was wired accordingly and installed inside the water-tight plastic box, in which there was fortuitously room to spare. Mountings were arranged on the side of the box to accept a small telescopic antenna. The system was quite portable and, when placed in situ, it was only necessary to switch on the receiver and camera batteries and retire to the remote transmitting location. Tests in a nearby park indicated that the camera could be operated reliably over distances of at least a quarter of a mile, representing a far greater distance than this particular application would be likely to call for.

The camera is intended for use in locations where the operator could not remain as, for example, in exposed positions alongside motor race tracks and in certain military exercises. It should also prove valuable for wild life photography. The camera used has a wide-angle lens, which allows a reasonable field to be shown on the prints, thus compensating for the reaction time of the operator and the camera mechanism and inability to orientate the camera from the operate position.

In its sealed, plastic case, the radio-controlled camera is propped in the grass near the winning post. Shown above is one of a series of pictures which it took.

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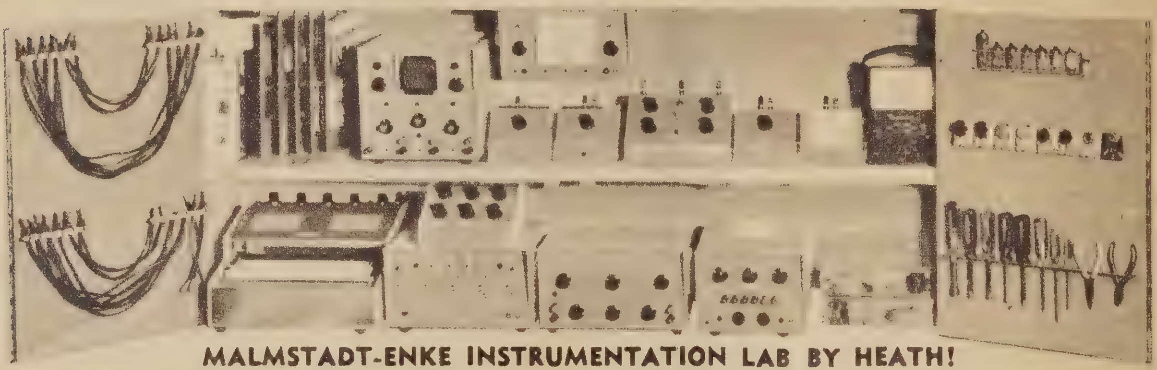

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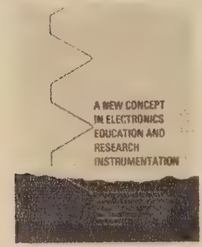

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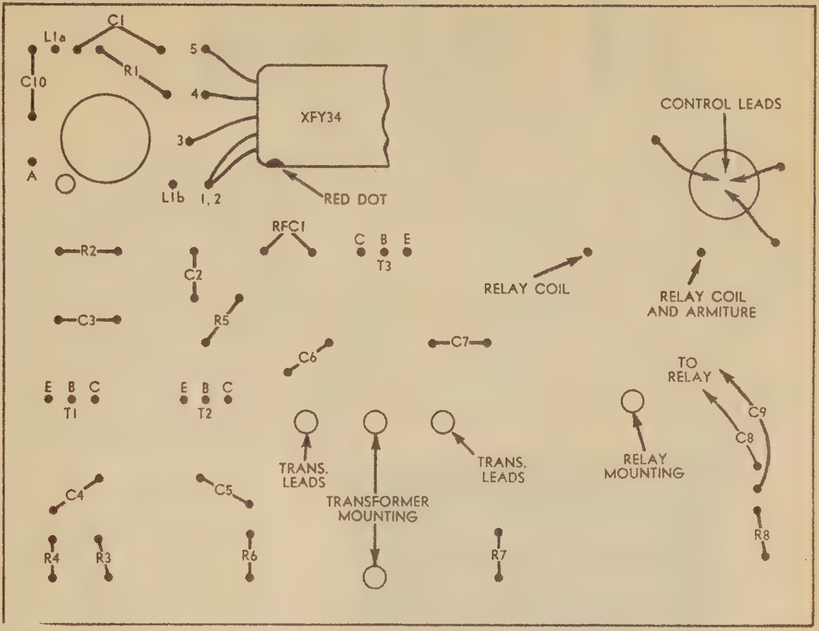
aerial which can be accommodated on a model.

As previously stressed, space is at a premium in most models and the remote control receiver must be made as small as possible. In the original design, components were chosen for size and mounted very close together. A drawing of the printed wiring board used is given with components suitably coded, so that the components may be mounted with a minimum of worry.

A 7mm coil former is supplied with the basic kit, together with a length of 28 B. and S. enamelled wire. It is necessary to wind a coil of 32½ close-wound turns to resonate at 27 MC. The coil former supplied is normally too long and it must be cut carefully to fit inside the case provided. The lip on one end of the former should fit tightly into the hole in the printed wiring board; it may be necessary to ease the hole in the board slightly, but do it cautiously.

Select the starting point for winding the coil about 3/16in from the end of this lip. From this point measure up the former approximately 9/16in and drill a fine hole just large enough to pass the 28 B. and S. wire. This hole should actually be made 180 degrees around the former from the proposed starting point to allow for the half-turn of the coil. To hold the start of the coil, use a small piece of plastic material, or paper folded in a loop around the first turn and laid along the former. The next few turns of the coil will bind this material to the former, keeping the beginning of the coil in place.



Below are two views of the receiver, seen from above the board. The layout of the components on the board is shown in the diagram above. All three illustrations are larger than the actual unit which measures about 2 x 1¾ x ¾ inches. The printed wiring board is illustrated in actual size overleaf.

The final turn of the coil should end close to the hole previously drilled and the end of the wire, about two inches long, should be passed through the hole into the centre of the former and out over the top. The coil may now be treated with lacquer and allowed to dry. Some of your sister's, wife's or mother's clear finger-nail polish is suitable for this application. When the coil former is fitted to the board, twist it so the coil leads fall opposite the correct mounting holes and glue it in place with good quality model glue or the same material as mentioned above.

From here on we suggest that you work from the centre of the board out to the edges when mounting the components, otherwise it may become difficult to fit things properly into place. The two tags on the transformer fold over and solder to the foil, making a solid mounting for this component.

For the valve specified no socket is used, the flying leads being soldered directly to the printed wiring board. At the base of the valve a red spot will be noticed; this indicates the number one pin of the valve and the rest of the pins are numbered in sequence, as shown on the circuit diagram.

The final connections to the board will probably be the wires from the relay

PARTS LIST

	BASIC KIT.
1	case, 2½ x 1⅞ x 1⅛ inches.
1	printed wiring board.
1	7mm coil former with slug.
1	length of wire for coil.
1	valve (XFY34). (Hivac).
1	single-pole double-throw relay, coil resistance approximately 4000 ohms.
1	Interstate coupling transformer.
1	1pF bead ceramic capacitor.
1	47pF bead ceramic capacitor.
	RESISTORS (all ½ watt)
1	10 ohm.
1	47 ohm, see text.
1	4.7K
2	10K
1	22K
1	100K
1	2.2 megohm.
	CAPACITORS
1	.001uF 160V plastic.
4	.01uF 160V plastic.
3	5uF 25VW electrolytic (miniature).
	MISCELLANEOUS.
1	22uH RF choke.
3	OC71, TS1, TS3Z, 2N217 transistors or equivalents.
	Solder, fibre board, self-tapping screws, grommets, etc.

22 RANGE

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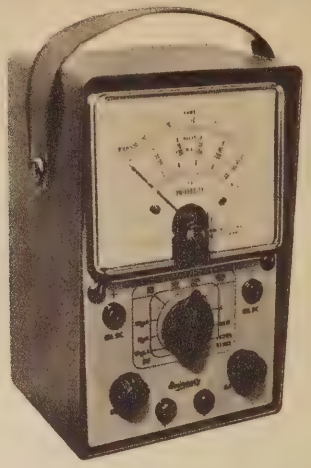
MODEL MVA3



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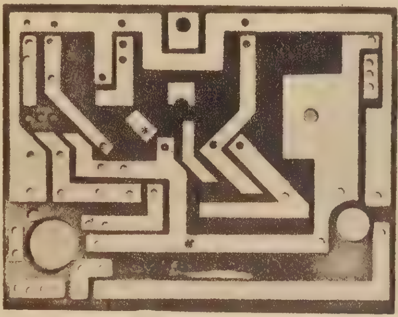
and to the batteries. In the prototype these were connected to a 5-pin miniature plug so that the receiver may be readily disconnected from the model for service or for interchange between models. In the circuit diagram we have suggested a colour code and the connections which could be made to the 5 pin miniature plug. The matching socket also shown in the diagram illustrates the connections to the batteries and control mechanisms.

When all the components are mounted, a small block of foam plastic should be cut out and pushed over the detector valve to protect it from vibration. Double-check the components, the polarity of electrolytics and the polarity of battery connections before applying power to the receiver unit.



To the right is an actual size illustration of the printed wiring board used in the construction of the receiver.

To set up the receiver correctly it is necessary to have available a meter capable of reading direct current say up to 10mA. The milliameter used for the tune-up monitor described with the transmitter can be used with an appropriate shunt. The prospective constructor could purchase the correct shunt when purchasing the meter and wire it with a switch in a box for protection purposes. Thus the meter could be used for both checking receivers and transmitters.

The meter should be connected in series with the positive lead to the 22.5V battery so that it will indicate the total current drawn by the receiver.

Initially, when the receiver is switched on without any transmitter in operation, the idle current should be approximately 2mA. If this current is exceeded the resistor R7 in TR3 circuit should be increased until the current is reduced to about 2mA. In our prototype we finished up with a 270-ohm resistor which would normally be the highest value required for correct operation.

Once the "idle" current has been adjusted, the unit may be fitted into the case. A thin piece of fibre insulating material should be laid on the case underneath the printed wiring board to prevent any short circuits from occurring. The wires from the board are fed through two rubber grommets. The slug of the coil is accessible through another hole in the case.

The board is held in the case by slightly crimping two sides of the case down on the board. The rest of the adjustments can now be made. At this stage a second pair of hands can be very helpful; if the assistant takes the control transmitter a few yards away and operates it with tone on low power, the receiver may be tuned to the signal.

First up, the receiver tuning coil slug should be adjusted so that maximum response is shown on the meter, about 5 or 6mA at close range; at the same time the relay should be in the energised position. When the tone is removed and carrier only transmitted, the meter should show approximately 1mA current drain the relay dropping out as a result. This stage having been reached, the transmitter should be moved further away and the receiver tuning peaked for optimum performance on the weaker signal.

The receiver is now ready for mounting in the model to be controlled. The unit should be mounted in such a way that the tuning adjustment is readily accessible, so that it may be checked periodically for optimum performance. This is necessary as the tuning may alter due to aging of components, effects of temperature or change of setting due to vibration.

At this stage, with the receiver suitably installed in the model, it is wise to become thoroughly familiar with the operation of the combined transmitter, receiver and control system. This is best done with the model stationary.

If a flying model is used, we must again stress the importance of experienced advice and tuition that can be obtained from Aero-model Clubs. For the newcomers in the field of aeromodelling a list of clubs in various centres is given with this article. If other clubs would like to supply the Secretary's name and address, we would be pleased to publish these in a subsequent issue.

Most of these clubs are only too pleased to give advice on selection of suitable models for radio control and to give practical tuition to the new flier.

Model boats and vehicles, fortunately, are not so likely to meet disaster if control is momentarily lost. A lot of pleasure may be had from the control of model boats especially and, if failure occurs, one usually needs only to be a good swimmer or rower to retrieve the model.

EDITOR'S NOTE: As already stated, the object of this article and the previous one has been to detail the radio link ending in a set of relay contacts at the receiver output. Commercial control mechanisms are available from hobby shops but readers would be well advised to familiarise themselves with modelling techniques before purchasing any particular type. We are hoping to be able to present some follow-up material which will be of further assistance along these lines.

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55 Adelaide Street, West Ryde, N.S.W.
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Mr Doug Doggett (Secretary),
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Flying Field: Near Rooty Hill Station.

MACQUARIE CLUB (M.C.).
Mr Dick Everett (President),
48 Albert Street, Ingleburn, N.S.W.
Flying Field: Minto.

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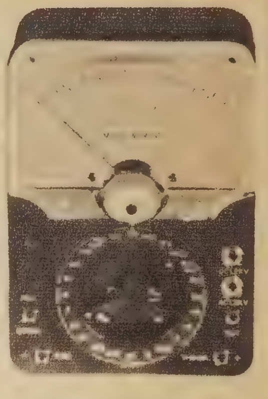

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OBSERVATIONS ON THE DELTAHET

It is well over two years since the Deltahet Front End was published and over a year since the Deltahet Communications Receiver made its appearance. Since then, it seems that many of these units have been built and there is every indication that its popularity is on the increase.

By Ian Pogson

CONSIDERING the number of front-end units and complete receivers which have been built already, it is significant that there have been relatively few calls for assistance. However, problems have cropped up, some having come to the notice of the writer. It is proposed to discuss some of these cases and the solutions may be helpful to others who may be having similar troubles.

Right at the beginning of the first article on this project we warned readers about its complexity but a few readers either did not read it, or chose to ignore it. Reports have it that one individual (bless him) even set out to prove the warning to be invalid! Isolated cases exist where the person just did not have requisite experience to tackle such a project. It seems, however, that the majority who have had trouble, either did not have, or could not borrow the test equipment needed to adjust and align the finished job.

Notwithstanding the foregoing remarks, some novices have demonstrated that they can do the job under strict supervision. Of course, the alignment still has to be done by one sufficiently experienced in the art.

A few readers have not followed all the information given in the articles, which prompts the remark that changes in component location, earth points and the substitution of components with unsuitable ones should be avoided. For example, the use of negative temperature coefficient ceramic capacitors instead of specified NPO types can only spell trouble. The remedy is obvious. Departures from the original specifications should only be undertaken if the position is fully understood.

Sometimes, when a unit has not functioned as expected in the early stages, without making a systematic search for the cause of the trouble, builders have seen fit to make substantial changes to the design, layout, shielding, etc., which can make bad matters even worse. More often than not, the trouble can be traced to some simple fault which may be cleared easily.

Another problem is lack of sufficient deflection of the pass-band display on the CRO, when aligning the 40MC filter. This usually turns out to be either insufficient gain in the CRO vertical amplifier, or errors made in connections of the elements in the 40MC filter.

If the CRO vertical amplifier is lacking in gain and access to a more suitable instrument is not possible, a simple pre-amplifier may be added external to the CRO input. More details of this will be given later on.

Assuming that the CRO is not to blame, the connections of the 40MC filter transformers should be checked carefully. If the phasing is not correct, more than likely the pass-band shape will be all right, but the insertion loss of the filter will be very high. Connections must be made as shown in figure 1. This may be cross checked with figure 2 on page 65 of the August, 1963 article.

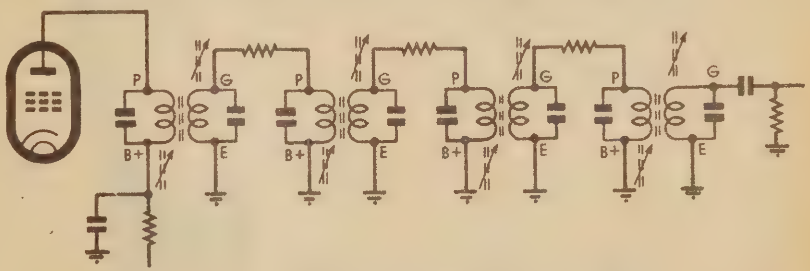

Figure 1: This circuit of the 40 MC band-pass filter shows the correct method of connection between adjacent transformers. This phasing must be observed, otherwise insertion loss becomes excessive, making alignment difficult and degrading performance.

Another point to watch, when losses are higher than normal in the 40MC filter, is the position of the centre slugs between the windings of each transformer. It is possible during alignment, to screw one of the adjustable slugs in too far, which displaces the centre slug. When the adjustable slug is screwed back, the centre slug remains out of position. This must be re-set and can only be done by removing the can from the transformer.

While on the subject of high losses, either real or apparent, in this part of the unit, at least one case has come to our notice where the builder, faced with the problem of insufficient vertical display on the CRO, put an amplifier in the middle of the 40MC filter! This is neither necessary nor desirable. More than likely, the trouble could have been traced to one of the causes previously mentioned.

Still on the 40MC filter, a much more subtle fault happened in one instance. In this case, it was not possible to tune the filter to 40MC. All circuits were high in frequency and refused to tune any lower. A close inspection showed that the builder had wound the coils carefully and with respect to all details. The capacitors across the windings were checked and found to be correct. This left nothing else but the slugs.

When the slugs were replaced with some of the specified grade, the filter was aligned to frequency without further ado. Slugs are available in various grades, which makes them suitable for certain specified frequency ranges. The different grades also differ in respect to permeability, with consequent variations in inductance obtainable with a given coil. The correct slugs as made by Neosid, are listed as grade 900. The approximate Ducon equivalent is Q2 material. Unfortunately, details of the slug which caused the trouble are not known.

The 37.5MC filter-amplifier has proved to be reliable, with just an odd case or so of instability. The amplifier stages have a high gain and instability has been traced to individual wiring variations. A minor rearrangement of wiring around the offending stage has cleared up the trouble.

"Breakthrough" at the 2 and 3MC points of the tuneable IF is nearly always due to insufficient selectivity in the 37.5MC filter. It will be remembered that the VFO or "megacycles" selector output, beats in the third mixer with that harmonic from the 1MC crystal, to produce a frequency of 37.5MC which will pass through the filter. It should also

---

Footnote: 0.5 to 30MC "Front End" For A Communications Receiver, was published in July and August, 1963, followed by the DELTAHET Communications Receiver in September and October, 1964. All four articles are necessary for full information on this project.

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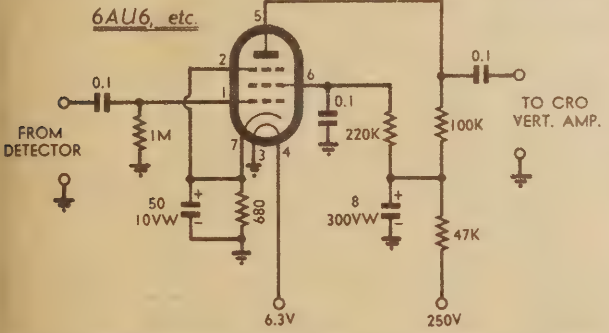
be noted that beats will be produced at 35.5, 36.5, 38.5 and 39.5MC. There will be others as well, but the ones mentioned are of immediate interest.

If the filter skirt selectivity is poor, although attenuated to a degree, the 36.5 and 38.5MC components will pass through the filter and appear at the second mixer. Here, they will beat together to produce sum and difference components of 75 and 2MC. The 75MC component is of no particular interest but it will be readily seen that the 2MC component will appear at one end of the tuneable IF as an unwanted breakthrough.

Suppose that we now consider 35.5 and 38.5MC, or 36.5 and 39.5MC. These two pairs of frequencies are 3MC apart. The components adjacent to 37.5MC will be passed by the filter as before. The other components under consideration, being 2MC away from the centre of the pass band, will be attenuated more than the adjacent ones but, if they get through the filter and to the second mixer, a beat of 3MC will be tuned at the other end of the tuneable IF scale. It should however, be somewhat weaker than the 2MC component.



The valve preamplifier circuit (figure 2) is shown at the left and a photograph above. It should not be used unless strictly necessary, as explained in the text.

When these two signals are of excessive strength, the cause is usually due to misalignment of the 37.5MC filter. When the alignment is corrected, it is normal to have a noticeable breakthrough still at the 2MC point but the one at the 3MC point should have been reduced to a low level, such that it will be of no consequence. The breakthrough at the 2MC point need not be any disadvantage, as any signal that is to be tuned in on an exact MC may be moved to the other end of the dial.

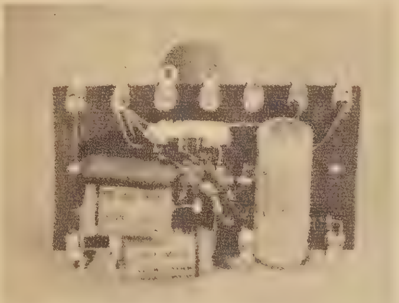
If the sensitivity of the receiver at lower frequencies is all right but there is a gradual falling off in sensitivity towards the high frequency end, the fault could lie in the plate coil of the harmonic generator. Although no slug was called for originally, experience has shown that, by the addition of a slug and suitable adjustment, the high frequency sensitivity can be brought up to what it should be.

This slug may be adjusted by more than one method but perhaps the simplest is to set the "megacycles" selector to 29MC. Then tune in a steady signal anywhere between 29 and 30MC, either from an external source, or from a signal generator. Now adjust the slug for maximum response, using the "S" meter for preference.

This just about covers the faults and problems which have come to our notice. However, one particular front end unit was delivered to the writer just recently, with the explanation that "it worked OK but all did not seem to be well." The former part of the explanation is still a source of wonder and the second part was an understatement, to say the least!

Without any reflection on the builder being intended, we would like to relate the story from which a moral may be deduced. In giving the details, it will be noticed that some of the points already discussed will be more or less repeated. It is difficult to know just where to start, but this is what happened, not necessarily in proper order.

Before applying power to the unit, the GDO was used to check the coils in the grid circuit of the RF stage. Then the three sections of the 0-32MC low pass filter were checked. These were near enough to the required frequencies, the small errors not being sufficient to affect the overall performance. Power was then applied and the results were far from satisfactory, so the obvious approach seemed to be a thorough overhaul.



An attempt was made first, to have a look at the pass band of the 40MC filter. Although a CRO was being used which is known to have adequate gain for this purpose, practically no vertical deflection could be obtained. In fact, no accurate measurement of the width of centre frequency of the filter was possible, but the centre frequency was later estimated to be about 41MC.

A systematic check was begun by feeding the sweep generator into the primary of the last transformer and the detector for the CRO was connected across the output of the second mixer. This transformer could be tuned to frequency, but gain and bandwidth were less than normal. An inspection of the transformer revealed that the centre slug between the primary and secondary windings was missing. A slug was fitted and the transformer behaved normally.

The sweep generator was moved to the primary of the third transformer. The bandwidth was O.K. but the gain was well below normal. This time the fault was traced to incorrect phasing of the connections of the transformer. When this was righted, the two transformers were aligned and the gain was restored.

The sweep generator was then connected to the second transformer. Once more the gain was below normal with the bandwidth all right. Again the cause was incorrect phasing. With the sweep generator fed into the first mixer, no trouble was experienced with the first transformer. The complete 40MC filter then behaved normally.

Having conquered the 40MC filter, we turned with renewed hope to the 37.5MC amplifier-filter. With the sweep generator fed into the third mixer, a reasonable pass band was obtained. However, it was soon evident that trouble was afoot. The marker generator indicated a centre frequency of just under 44MC. A quick calculation shows that this frequency is roughly 2.5MC above instead of below, the approximate frequency to which the 40MC filter was originally adjusted. Under these conditions, it did work, but more of that anon.

Obviously, the filter had to be tuned to 37.5MC but efforts to do this ended in failure. It was not possible to bring the circuits any lower than about 40MC. We removed the transformers to find the reason, which was immediately evident. The details given for winding these transformers, called for seven turns on each winding. For reasons that remain obscure, each winding had only six turns. This indeed was the cause of the trouble. The three transformers were rewound and they tuned to 37.5MC without further complications. Just in passing, there was a dry joint in one transformer which gave an intermittent effect in the earlier stages.

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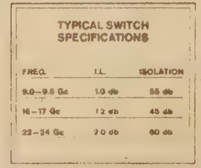

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22	Playmaster Unit	3
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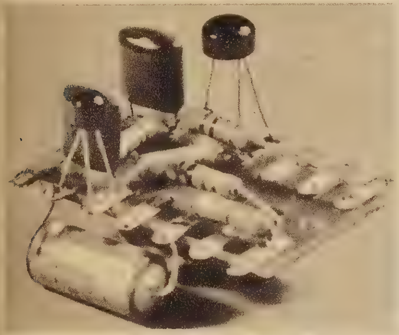
So far, so good. By now, the unit was starting to behave reasonably well. Sensitivity was still down on the higher frequency ranges, so we decided to make a check on the effect of tuning the plate coil of the harmonic generator. We selected the 29-30MC range and fed in a signal from the signal generator. Adjusting a slug in the plate coil had the desired effect and the sensitivity came up to normal level.

The owner of this unit had complained in the past of not being able to receive anything above about 15MC. As it turned out, there were two main reasons for this. The need to tune the plate coil of the harmonic generator to raise the level of the higher order harmonics was one and it will be remembered that the 37.5MC amplifier-filter was tuned initially to about 44MC. As this is approximately 2.5MC above and not 2.5MC below the 40MC filter, harmonics as required from the 1MC crystal were five higher in order than they should be, which made the position worse than ever.



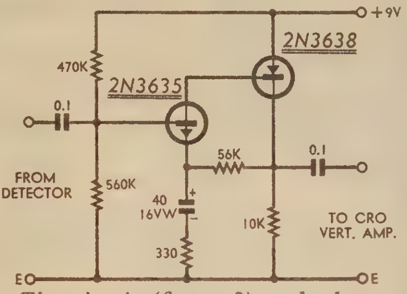
The items which we have just described, were the major ones but to keep the records complete, some more points are worthy of mention. Somewhere along the way, we noticed that the 500uH RF choke in the plate of the crystal oscillator and the 2.5mH RF choke at the second mixer, were transposed. These were changed over and gave a small improvement in performance.

The builder did not adhere strictly to the original layout. In particular, the lead-through capacitors were placed differently which necessitated somewhat longer leads than normal. The 1MC crystal was placed underneath the chassis, which meant that the wiring around this area was rather cramped.

This is of no real importance, but it does go to show just what lengths some builders will go to. The unit under discussion was built on a professionally made plated steel chassis. The builder went to no end of trouble to line the inside of the chassis with tin plate, so that components could be soldered directly to the chassis as well as making it possible to solder some of the shield partitions to improve the shielding. From results observed, it is doubtful if any benefit has been obtained. Personally, we do not think it is worth it and it is not recommended.

In spite of all the faults in this unit, it did work and gave some measure of satisfaction to the owner. It is worth noting that on the 80-metre amateur band, the Deltahet was able to resolve weak signals when a commercial piece of equipment could not. In point of fact, the writer was involved directly in a report of this kind. This speaks well for the signal-to-noise ratio of the Deltahet.

To change the subject, we turn our attention to pre-amplifiers for sweep alignment as mentioned earlier. Where gain is lacking in the CRO vertical amplifier, it is an easy matter to fit a single stage outboard amplifier to make up for the deficiency. Although we are giving details of amplifiers for this purpose, we would like to stress that the wiring of the 40MC filter should be checked before this measure is taken. More than likely, the pre-amplifier will not be necessary.



The circuit (figure 3) and photograph of a transistor version of the pre-amplifier are also given, the gain being comparable with the valve unit. As mentioned previously, its use should be restricted to cases of inadequate CRO gain.

Two amplifiers are given, one using a 6AU6 valve and the other one a transistor version with two transistors, types 2N3635 and 2N3638. The circuits are shown in figures 2 and 3 respectively Photographs give a good idea how each assembly has been arranged and these, with the corresponding circuits, should be sufficient information to make either one. The transistor version can be easily overloaded but will accept at least 25mV before overload is evident.

Whichever amplifier is chosen, it is only necessary to "hang" it on the CRO input terminals with short leads. A source of 6.3 volts and about 250 volts of HT are needed for the valve and a nine volt battery for the transistor version. With the detector connected to the preamplifier input, there should be more than enough gain to give a full display when aligning the 40MC filter. The preamplifier should not be used when aligning any of the other circuits of the Deltahet receiver.

A list of DC voltages follows.

V.1	Pins 1 and 3	0.75V	V5.	Pin 1	57V
	Pin 7	140V		Pin 3	24V
	Pin 8	72V		Pin 6	60V
				Pin 8	27V
V2.	Pins 1 and 3	2.2V	V6.	Pins 3 and 8	1.5V
	Pin 7	137V		Pin 1	145V
	Pin 8	137V		Pin 6	46V
V3.	Pin 7	142V	V7.	Pins 1 and 3	1.35V
	Pin 8	58V		Pin 7	145V
				Pin 8	118V
V4.	Pin 5	115V	V8.	Pins 1 and 3	1.55V
	Pin 7	118V			

These were measured on the front-end section of the Deltahet Communications Receiver as published in September, 1964. The HT supply is 150 volts and measurements were made with a 20,000 ohm/volt meter, RF gain control at maximum and no aerial connected. These voltages are intended as a guide and variations up to 10 per cent would be expected. ▬

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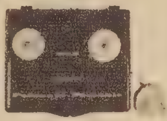

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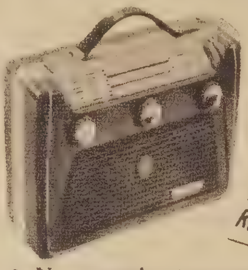

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by JAMIESON ROWE

The Triac is closely related to the Silicon Controlled Rectifier (SCR) or "Thyristor"; it is a multi-layer silicon device which is triggered into conduction by a gate signal, in a manner similar to the thyristor. However, whereas the thyristor is virtually a controlled diode, and is able to conduct in only one direction, the Triac behaves somewhat like two thyristors connected in inverse parallel — it can conduct in both directions of current flow, with conduction triggered by signals from a single gate connection. This makes the Triac ideal for use as an AC power control.

As the Triac is a somewhat complex multi-layer device, a full description of its operation is beyond the scope of this article. However inasmuch as for the present purpose it can be regarded as the equivalent of two inverse-parallel connected thyristors sharing a common case and gate, it may be worthwhile to discuss briefly the operation of a standard thyristor.

The thyristor is a four-layer PNPN silicon device which can be represented as in figure 1. Three of the silicon layers have associated ohmic connections — the top P-type layer, termed the "anode" (A), the lowest N-type layer, termed the "cathode" (K), and the P-type layer nearest the cathode, termed the "gate" (G).

The thyristor is normally connected in series with a load and a source of current, shown here as a resistor and a battery V respectively. Note that the positive polarity of the supply connects to the anode, and the negative polarity to the cathode. Thus the P-N junctions 1 and 3 of the device are forward biased, but the N-P junction labelled 2 is reverse biased.

Because the centre junction is reverse biased the device as a whole behaves as a high resistance; only leakage current flows and, as the semiconductor concerned is silicon, this leakage is very small. As far as the load is concerned, the thyristor in this state is virtually open-circuit or "off".

There are a number of different ways in which the device can be changed from this "off" state into one in which it is conducting heavily or "on" and each of these ways depends upon two main principles.

The first of these is that the thyristor, by virtue of its PNPN structure, tends to amplify its own leakage current. It acts like a combination of two transistors — a PNP (the top three layers) and an NPN (the three lowest layers) — which share the one collector-base junction. The base of each one is the collector of the other, so that they tend to amplify each other's collector-base leakage current.

The second main principle of operation is that the gain of the amplification processes within the thyristor is directly proportional to the current flowing. In other words, the two inbuilt "transistors" have a current amplification which is very low at low current values but which rises as the current rises. The dependence of current gain upon current tends to be a characteristic of all silicon devices.

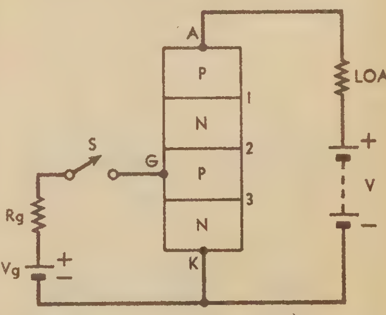
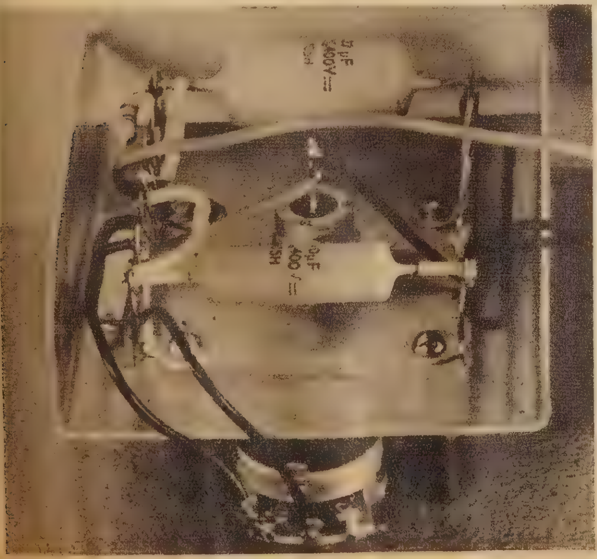


Figure 1: A diagram used to explain the operation of the thyristor or "SCR," from which the Triac device was developed.



A view of the rear of the front panel of the Vari-watt, showing the heat-sink bracket, the Triac and Diac, and the other control components. Note the fibre insulating posts, necessary as the bracket becomes "live".

The thyristor passes only leakage current in its "off" state because, at this value of current, the internal amplification processes have less than unity gain; if you like, the internal "transistors" have virtually no gain to amplify each other's leakage. However if the current **in even one** of the junctions of the device is increased in some way, the gain will rise. And if it is raised to the point where it exceeds unity, regeneration occurs — the gain increases the current, the current the gain, and so on until the device saturates. Its voltage drop falls close to that of a single forward-biased junction.

The various ways of "turning on" the thyristor are simply alternative ways of producing the required initial increase in current through one or more of the junctions:

(a) As the leakage current is proportional to the applied voltage, V can be increased to the point where the leakage current itself rises to the value to start regeneration.

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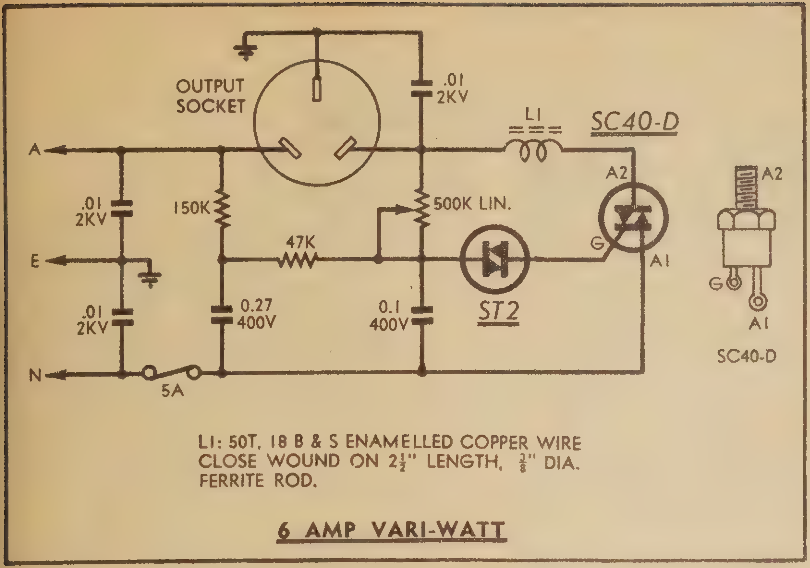

Here is the circuit for the Vari-watt, showing the small number of components required. The 500K pot controls the power fed to the output socket by varying the conduction point of the Triac over each half-cycle.

LIST OF PARTS

- 1 Small sloping-front metal case, 5in x 5in x 5in.
- 1 G-E "Triac" silicon controlled AC switch, SC40-D.
- 1 G-E "Diac" symmetrical breakover diode, ST-2.
- 1 500K linear carbon potentiometer.
- 1 47K ½-watt resistor.
- 1 150K ½-watt resistor.
- 3 .01uf 2KV ceramic capacitors.
- 1 0.1uF 400V plastic or paper capacitor.
- 1 0.27uF 400V plastic or paper capacitor.
- 1 3-pin power socket.
- 1 5A fuse cartridge and holder.
- 1 Large instrument knob.
- 1 Length 10A power flex (3-core) and 3-pin plug.
- 4 1in fibre rod spacers, blind-tapped 1/8in Whit. each end.
- 1 2½in length 3/8in ferrite rod, few feet 18G enamelled copper wire and plastic insulation tape.

Connecting wire, solder, etc. Scraps of 16G aluminium sheet, 5in x 3½in and ½in x 1½in, to make heat-sink bracket and mains cord clamp. Rubber grommet, 3/8in diameter.

(b) Similarly, as leakage current is also dependent upon temperature, the temperature may be increased to the point where the leakage is able to start regeneration. Actually, temperature triggering is rarely used in practice, but as LIGHT energy has a similar effect, some thyristors are provided with small windows to permit triggering with a light beam.

(c) As the junctions of the thyristor possess capacitance, a sudden increase in the voltage applied to the device can cause a momentary capacitive current flow which is sufficient to raise the internal amplification above unity and cause switching. Thus, irrespective of the amplitude of the applied voltage, if its rate of change is sufficient, so-called "dv/dt" switch-on can occur.

(d) The usual way of triggering the thyristor into conduction is by means of the gate electrode G, connected to the P-type layer nearest the cathode. Only a small forward bias connected across the gate-cathode junction "3" is sufficient to raise its current to the point where the gain of the internal "NPN" transistor rises above unity and produces regeneration. Thus in figure 1 if switch S is closed the small current which flows due to Vg and Rg is sufficient to trigger the thyristor into conduction.

It should perhaps be noted that if an electrode were attached to the N-type layer adjacent to the anode, a small negative bias applied between this electrode and the anode could alternatively be used to trigger the thyristor into conduction. In this case it would be the internal "PNP" transistor which initiated the switching action.

Once the thyristor is "on," it generally stays in this state until the supply voltage is removed. Thus the thyristor behaves rather like a thyratron valve, in that once it is conducting the gate electrode has little effect — although some thyristors are especially designed so that a suitable signal applied to the gate may be used to "kill" the internal amplification and turn the device "off." But with most common thyristors this is not possible.

Because of its self-latching behaviour the thyristor is ideal for use in AC circuits in which the supply voltage periodically falls to zero. While bias current is applied to the gate electrode, the thyristor will pass every half-cycle of the appropriate polarity but, when the gate bias is removed, it conducts only until the half-cycle in progress has ceased. Hence the suitability of the thyristor as a controlled rectifier.

However, as the thyristor will conduct in only one direction, two thyristors must be used where full-wave rectification is required. Similarly, in cases where AC control is required **without** rectification, two thyristors must again be used, unless arrangements are made using standard silicon diodes to "shuttle" the alternate half-cycles of AC through a single thyristor.

The Triac device was developed from the thyristor by the General Electric Company to provide a simple means of controlling AC power where rectification is not required. Although, as mentioned earlier, its internal construction and theory of operation are rather complex (its equivalent circuit contains not 2, but 7 transistors!), it behaves basically somewhat like two thyristors connected in inverse parallel — sharing a common case and gate electrode. If this is kept in mind it should not be hard to follow the operation of our "Vari-watt" circuit.

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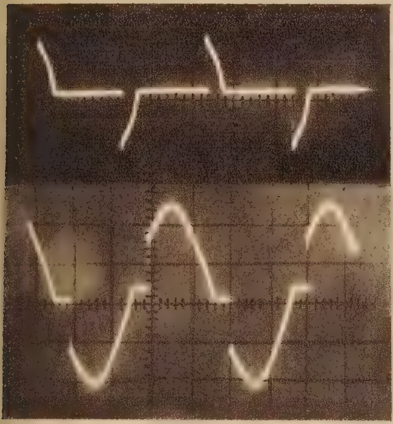


Figure 2: Oscillograms taken from the output of the Vari-watt, showing how it controls load power. At the top is the load voltage with the Vari-watt set for low output, and below for a somewhat higher output. Note the rapid switch-on in both cases.

As may be seen, the Triac is wired in series with the output socket, together with a protecting fuse and a small inductor which will be discussed later. With the exception of the three .01uF 2KV capacitors, whose purpose will also be explained later, the remainder of the components are for the purpose of triggering the Triac to provide a variable control over the power fed to the load.

As the Triac is basically an "on-off" device like the thyratron valve and the standard thyristor, it cannot be used as a simple "variable series impedance" power controller. The only means by which it can be used to provide a gradual control of power is by using it as a rapid switch which "lets through" a variable amount of each AC half-cycle—by adjusting the instant in each half-cycle when it triggers into conduction.

The oscillograms of figure 2 should help in understanding this; they were taken from the output of the "Vari-watt" when it was passing a fairly low power (a) and a fairly high power (b) to the load. In the first case the Triac is made to conduct late in each half-cycle, only "letting through" the last part of the half-wave; whereas in the second case the Triac is made to conduct early in each half-cycle to "let through" most of the half-wave.

Thus, by simply varying its triggering point, the Triac may be used to vary the power to the load continuously from "zero" to "full on." Zero corresponds to the triggering being delayed until the half-cycle has ended, so that the Triac only turns on when there is "nothing left."

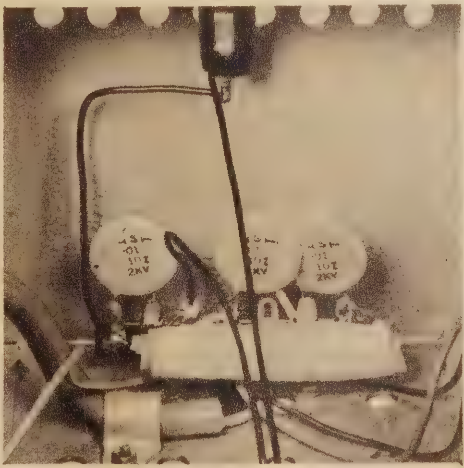
Although the triggering point of the Triac may be varied by feeding the gate electrode with a variable DC bias, a variable AC bias or a mixture of the two, such methods are not very satisfactory. They tend to produce somewhat erratic triggering, because the rate of approach of the bias to the critical triggering value is rather low and susceptible to interference from line transients. Apart from this it is usually only possible to control the Triac over the first half of the AC half-cycles, giving a limited range of control.

It should perhaps be noted in passing that the same criticisms of simple DC and AC triggering apply both to the thyratron valve and to the standard thyristor. They are by no means peculiar to the Triac.

As with these other devices, the most satisfactory method of varying the triggering point of the Triac is by the method of "phase control." This involves feeding the gate electrode with a sharp pulse whose phase relative to the AC half-cycles can be varied.

While this may sound rather complicated it can in fact be done quite simply. If a capacitor is connected across the Triac in series with a variable resistor, it will tend to charge up during each half-cycle of the applied AC because of the voltage drop across the "off" Triac. The time which it takes to charge up will depend upon its value and that of the series resistor: if the resistor is varied the charging time can be altered.

To use this arrangement to provide a sharp variable-phase trigger pulse to the Triac gate it is simply necessary to arrange for the capacitor voltage to be fed to the gate via a voltage-sensitive breakdown device—one which only conducts when a certain voltage is applied. Varying the resistor in series with the timing capacitor thus controls the phase of the pulse fed to the Triac gate because it determines the instant at which the capacitor voltage reaches the "firing" voltage of the breakdown device.



A view inside the case of the Vari-watt, showing the interference suppression coil and capacitors. Note the small clamp used to retain the end of the mains input cable.

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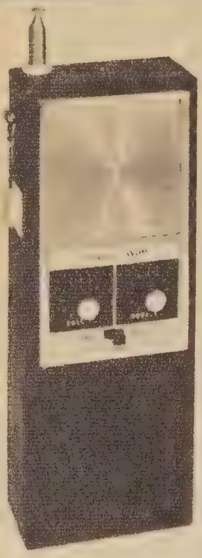

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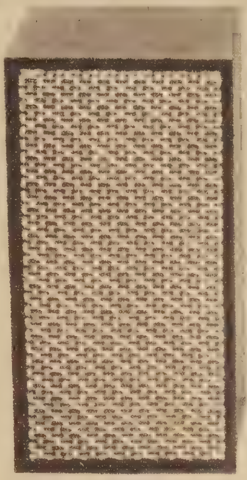

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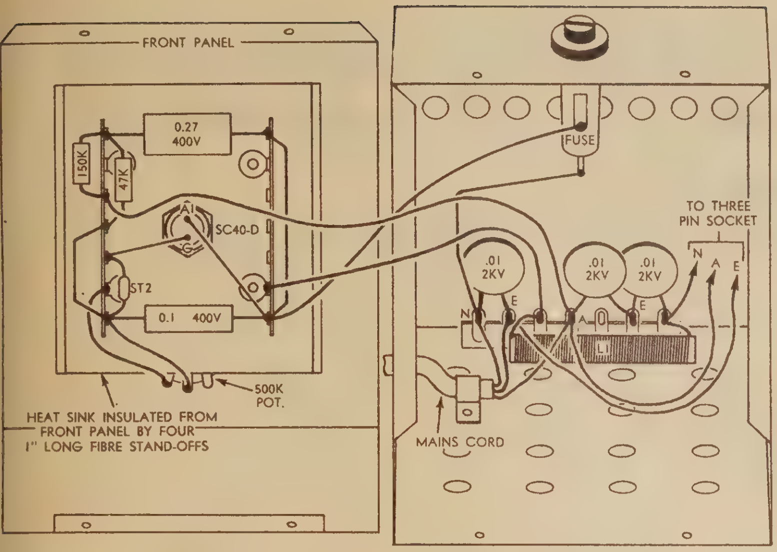

Using this complete wiring diagram and the photographs and circuit, it should be an easy task to copy the original unit. Don't forget to ensure that the metal case is connected to the earth lead. As the wiring and heat-sink bracket are all "live", the unit should not be connected to the mains until fully enclosed in the case.

relatively small gate triggering pulse is required by the Triac or thyristor, a neon bulb can be used as the breakdown device. As typical neons "fire" at about 80 volts, the timing capacitor and variable resistor are thus designed so that the time taken for the capacitor to charge to 80V can be varied from almost zero to about 10 milliseconds — the time for one half-cycle of the AC. This varies the neon firing point and the consequent trigger pulse from the start to the end of the AC half-wave.

The triggering current required by a medium-power Triac like the SC40-D is rather too high to permit the use of a standard neon bulb as the breakdown device. For this reason the General Electric Company make available a special three-layer symmetrical breakdown diode, the "Diac," designed expressly for triggering Triacs like the SC40-D. The Diac is effectively an open-circuit until the applied voltage rises to its breakdown voltage, when it becomes a low negative resistance.

The ST-2 Diac has a breakdown voltage of approximately 32V in both directions, and is able to carry a peak discharge current of 2 amps. It will easily provide the 3V triggering voltage for the SC40-D Triac when discharging a 0.1uF capacitor.

In the circuit of the "Vari-watt" the 0.1uF capacitor is the timing capacitor and the 500K pot the variable charging resistance which becomes the "power output" control. The ST-2 Diac connects to the junction of the two, so that when the capacitor charges to 32V it "fires" and discharges the 0.1uF capacitor through the G-A1 section of the Triac to trigger it into conduction.

The 0.27uF capacitor and 47K and 150K resistors are additional components which improve operation at the lower end of the control range (when the charging pot is at maximum) particularly with loads having an inductive component. Note that the 150K resistor connects to the supply line side of the output socket; this is to compensate for the back-EMF produced by inductive loads.

It remains to explain the purpose of the three .01uF capacitors and the small inductor L1. These are for interference suppression; as may be seen from the oscillograms of figure 2, the Triac switches "on" extremely rapidly. The resulting rapid rise in current tends to radiate interference to nearby radio receivers and amplifiers unless it is suppressed.

With the three bypass capacitors and L1, which is some 50 turns of 18G enamelled copper wire wound on a 2½in length of 3/8in ferrite rod, the interference is quite low. In our tests a sensitive mantel radio operating some ten miles from the stations on only a foot or so of aerial produced negligible interference when tuned to a station and plugged into the same wall outlet as the Vari-watt operating under load. A high-gain stereo system plugged into the same outlet as the Variwatt and turned full on produced an audible buzz, but interference was negligible at normal operating gain settings.

The construction of the Vari-watt is fairly straightforward. All the components fit into a small sloping front metal case measuring 5in x 5in x 5in, with the control knob on the sloping panel. The input mains cord enters the case on the left-hand side, and the output socket is mounted on the right. The fuse, a cartridge type, mounts on the top for easy replacement in an emergency, and four rubber feet complete the unit.

Inside the case the largest object is an aluminium heat-sink bracket used to provide cooling for the Triac. The bracket is bent up from a 5in x 3½in scrap of 16G aluminium sheet, bent into a "U" measuring 3in x 1in x 3½in. It provides some 35 square inches of surface area.

An important point to note is that the hole in the centre of the bracket used to mount the SC40-D Triac should be

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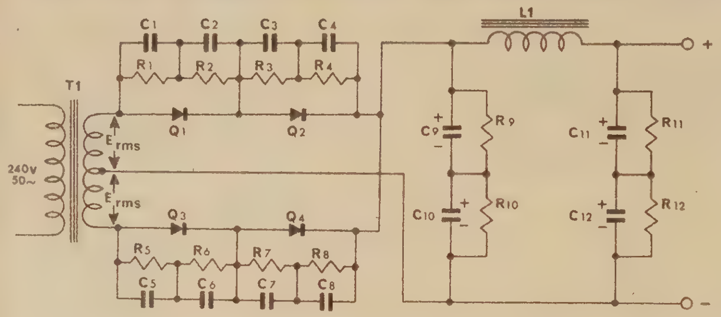

C1-C8	.0022 ufd 600 V.W.
C9-C12	64 ufd 350 V.W.
R1-R8	270K ohm ½ Watt Carbon
R9-R12	25K ohm 5 Watt Wire Wound
L1	5 Henry Choke (Ferguson CF113, A & R 3047, Trimax TZ467)
T1	350-0-350 V at 200 MA A & R PT1938 VO=490 V.DC 180 MA 385-0-385 V at 250 MA Ferguson PF171 VO=500 V.DC 230 MA 400-0-400 V at 250 MA Trimax TP4327 VO=520 V.DC 230 MA
Q1-Q4	Anodeon IN3196 800 PIV Rectifiers

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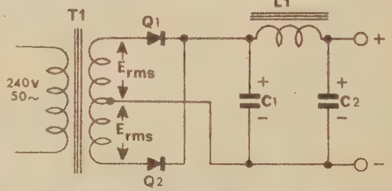
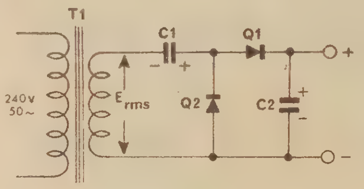
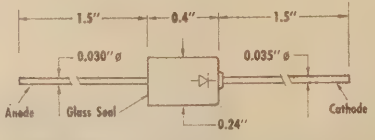


C1-C2	64 ufd 525 V.W.
L1	12 Henry 150 MA (Ferguson CF108, A & R 3042, Trimax TZ465
T1	250-0-250 V at 150 MA (Ferguson PF1508, A & R PT1896)
Q1-Q2	Anodeon 1N3196 800 PIV Rectifiers

45 VOLTS 45 MA FOR BIAS SUPPLIES



C1	100 ufd 50 V.W.
C2	100 ufd 100 V.W.
T1	18.9 V RMS Three 6.3 V Heater Windings in series
Q1-Q2	Anodeon AD100 100 PIV Rectifiers



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Type of Load		CAP	CAP	CAP	CAP	CAP	CAP
Maximum Peak Inverse Voltage	V	100	200	400	600	800	1000
Maximum RMS supply voltage	V	35*	70*	140*	210*	280*	350*
D.F. Forward current at 25°C	MA	500*	500*	500*	500*	500*	500*
D.F. Forward current at 75°C	MA	500*	500*	500*	500*	500*	500*
Recurrent surge current	A	6	6	6	6	6	6
One cycle surge current (50 cps)	A	35	35	35	35	35	35
Max. Forward voltage drop at 500 mA	V	1	1	1	1	1	1
Max. rev. current at rated PIV and 25°C	UA	5	5	5	5	5	5
Max. average full cycle rev. current at Max PIV and 750 MA If at 75°C	UA	200	200	200	200	200	200

* For Resistive Loads Double Max. RMS Supply Voltage and Increase Forward Current to 750 MA

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GENERAL ACESSORIES: Stores Throughout Australia are also Holding Stocks a close fit for the Triac stud. A loose fit will result in inefficient heat transfer, and could result in ruin of the Triac under prolonged full-load operation. The hole should be ¼in diameter, and free from burrs.

As the bracket is connected to A2 of the Triac it is "live," and must be insulated from the EARTHED metal case. This is done by supporting it on four 1in long fibre rods, blind-tapped 1/8in Whitworth at each end. Four countersunk-head screws fasten the rods to the front panel, while screws fastening the bracket to the rods are also used to mount two 7-lug tagstrips used to support the Diac, 47K and 150K resistors and 0.1uF and 0.27uF capacitors.

The SC40-D Triac and ST-2 Diac may be ordered **via local parts suppliers** from Watkin Wynne Pty. Ltd., of 32 Falcon Street, Crow's Nest, N.S.W. Although these components between them will cost something like £6/15/ (13.50 dollars), this will be the major expenditure for the project.

The mains cord terminations and the interference suppression components are supported by a third 7-lug tagstrip mounted in the lower part of the case proper. The mains cord is clamped under a small strip of aluminium to prevent strain on the soldered joints.

The metal case is provided with two rows of 8 x ¼in holes along the top of the rear face, and a pattern of 16 of the same diameter holes in the bottom face. This allows the entry and exit of air currents for convection cooling.

Using the wiring diagram, the circuit and the photographs as a guide it should be a simple matter to wire up the Vari-watt. Note that the ST-2 Diac has no preferred polarity; it can be wired in either way round.

The interference suppression inductor L1 is quite easily made; start by winding a layer or two of thin plastic insulation tape on the 2¼in x 3/8in dia. ferrite rod (if only a full length rod can be purchased, file a nick around it 2¼in from one end and snap the rod as if it were of glass—don't try to saw it). Then close wind 50 turns of 18 B & S enamelled wire over the tape; this number of turns will just fit in one layer with 1/8in to spare at each end. Finally, cover the winding with another layer or two of insulation tape.

As the ratings of the SC40D allow for the initial current surge of a cold 1200 watt lamp load, the Vari-watt can be used safely with loads up to this value. Thus it can be used to dim lamps in the home or in small halls, as well as to control the heat of single-bar radiators and ovens up to 1200 watt capacity. Note, however, that we have specified a 5-amp fuse. This should be used for normal applications as it will carry a little more than 5 amps continuously yet will blow quickly in the event of a short-circuit; a 10-amp fuse is not recommended.

The Vari-watt is not suitable for use with fluorescent lamps. Although it will "turn down" fluorescent lamps that are already on, "turning up" is almost completely controlled by the lamp starter and ballast and almost no control is possible. Dimming fluorescent lamps requires rather special circuitry.

The unit should not be used to control the power fed to radio receivers, television sets or other electronic equipment. The power transformers of such devices do not take kindly to the gated sinewave output of the Vari-watt, and transients may be generated which could damage either the equipment or the Triac.

It will be found that the Vari-watt will provide a satisfactory speed control for power tools having "universal" or series-type motors, in applications where little torque is required at the reduced speed. Thus it may be used to reduce the speed of an electric drill for boring holes in plastic or fine holes in wood or metal.

As the Vari-watt contains no circuitry to maintain a constant power in the load, however, power tools will tend to exhibit reduced torque at low speeds. To provide constant torque speed control a somewhat different type of circuit is required, employing feedback which monitors the motor voltage.

In due course we hope to be able to describe such a unit, if there proves to be sufficient reader interest.

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GE:P239

Pictured above is the all-channel log-periodic dipole antenna, for which dimensions are given on the next page. Note the brace which minimises sagging of long booms. In a typical installation ribbon stand-offs would be fitted to the boom brace and mast to hold the ribbon in place.

For TV and communications

LOG PERIODIC DIPOLE ANTENNAS

Last month, we published general design information for log periodic dipole antennas of the basic twin-boom pattern. This month, we describe an adaptation of the principle aimed at using a conventional single-boom structure and suitable for direct connection to a 300-ohm balanced feeder. Details are given for a wide-band antenna covering 45-222MC, as well as for single-channel log periodic dipoles for TV and the VHF amateur bands.

By Keith Woodward — Part Two

USING the twin boom system, as described last month, the constructor is faced with the problem of insulating the two booms and of maintaining even spacing throughout the full length. Without very substantial insulators, the twin section may tend to twist. Again, the lower frequency arrays at least, pose the problem of attaching the elements to the feeder-booms without intruding into the hollow tubes and fouling up the balun matching system.

After considering various ways in which a twin boom antenna might be constructed, we decided to investigate instead the idea of supporting the elements from a single boom, using standard TV fittings for insulated dipoles; further, in the absence of the twin feeder-booms, to interconnect the dipoles with a cross-phased harness of light TV practice.

In fact, because we had a practical objective in view, it was decided to try out the system in the shape of a prototype antenna designed to encompass the full frequency range from (and including) channel 0 to channel 11. At the same time, an attempt would be made to modify the impedance characteristic to match it directly to 300-ohm twin lead, without the need for an intervening balun.

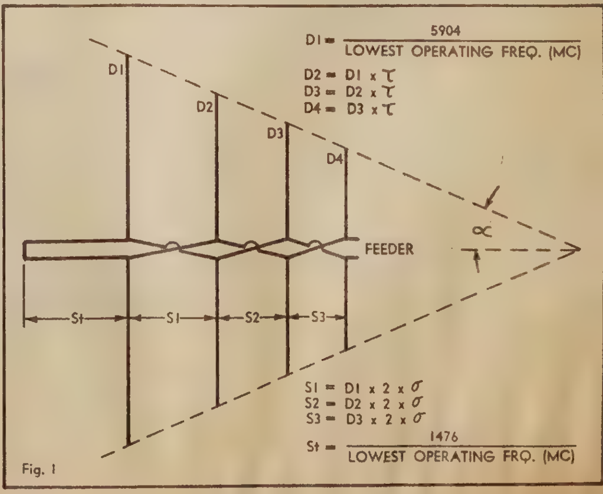
In covering the proposed frequency range from 45 to 222MC, the antenna would be ideal for the avid VHF listener, since it will take in all the Australian TV channels, the 52 and 144MC amateur bands and other transmissions in this portion of the spectrum. For the favourably located TV viewer, it could be rotated to provide a wide choice of TV programs.

One complication should be mentioned, however, namely the necessity to have the correct polarisation for the transmission being received. Provision would have to be made, where necessary, to hinge the antenna so that it could be swung for either vertical or horizontal polarisation.

As a starting point for the prototype antenna, the element lengths were cu to the same size as for a standard twin-boom log-periodic dipole antenna. Thi left the problem of the dipole spacing as against conductor length betwee dipoles, crossed conductors being slightl longer than parallel conductors bridgin the same distance. Should we make th spacing by the standard formula an accept the incorrect length of harnes in between, or, conversely, make th conductor length correct and accept th spacing that resulted?

It was decided to adopt the secon approach by using the calculated lengt of harness and accepting the spacin that resulted. It was postulated that th slight difference in spacing would hav little effect on the frequencies under consideration but that the position migh

Figure 1: This diagram illustrates the interconnection of adjacent dipoles and gives the formulas used in establishing antenna parameters. See Part One of this article relating to values for Tau and Sigma.



have to be reconsidered above, say, 250MC. By reducing the size of the centre insulators at the higher frequencies, the percentage of spacing error could be correspondingly reduced.

The materials for the prototype antenna (insulators, hardware, etc.), were supplied by Antiference (Aust.) Pty. Ltd., who also placed the facilities of their laboratory at our disposal for field tests of this and other log-periodic dipole antennas.

The procedure involves mounting the antenna on a tower, on a remotely controlled rotator, and using it to pick up modulated test signals on selected frequencies. A detector circuit is mounted directly at the feed point of the antenna and the detected voltage is fed as a demodulated signal through a suitable cable to a polar diagram recorder.

The polar diagram recorder is synchronised with the rotator on the tower and a direct plot for any position for the antenna is automatically obtained.

The polar diagram charts used are completely circular and are calibrated in decibels against a reference level which is the outer circle. Typical examples of these charts are reproduced herewith but the sections of the charts unused have been trimmed to save space.

The recorder is adjusted to the reference level on the chart with the antenna under test at its maximum response position, usually the front of the antenna. After each frequency plot of the test antenna is made it is replaced with a resonant dipole and the chart marked with relevant gain compared to the reference level. Using this method the forward gain and

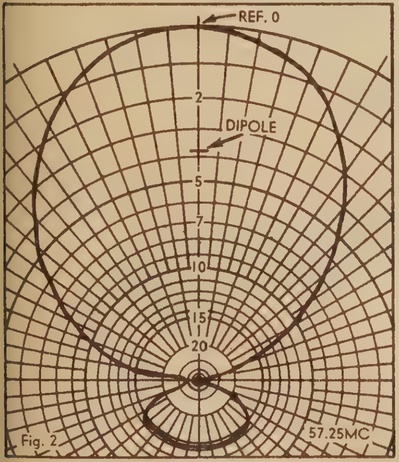


Fig. 2

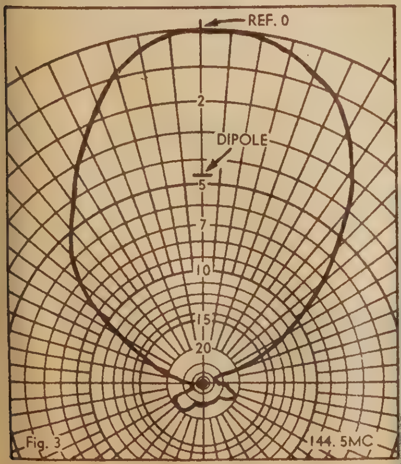


Fig. 3

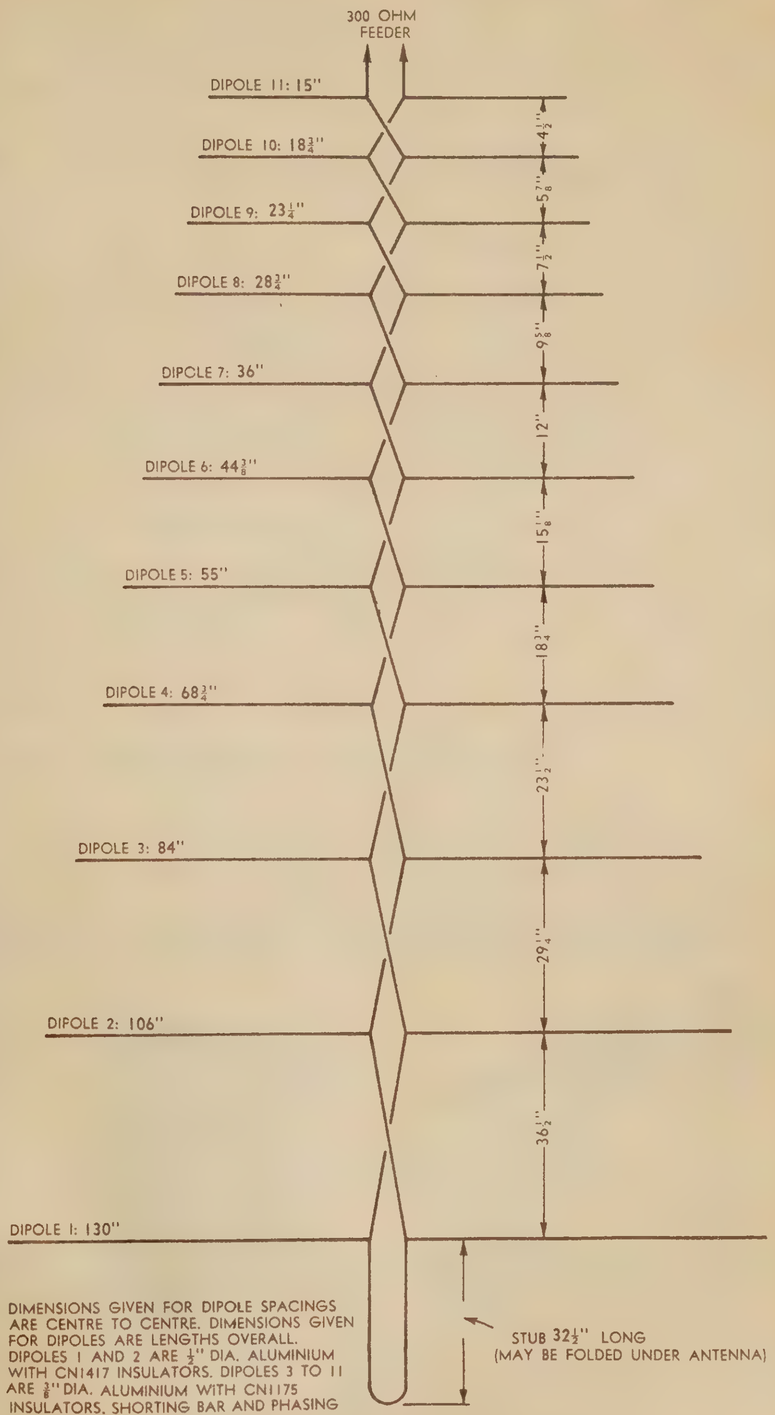

300 OHM FEEDER
DIPOLE 11: 15"
DIPOLE 10: 18$\frac{3}{4}$"
DIPOLE 9: 23$\frac{1}{4}$"
DIPOLE 8: 28$\frac{3}{4}$"
DIPOLE 7: 36"
DIPOLE 6: 44$\frac{3}{8}$"
DIPOLE 5: 55"
DIPOLE 4: 68$\frac{3}{4}$"
DIPOLE 3: 84"
DIPOLE 2: 106"
DIPOLE 1: 130"
4$\frac{1}{2}$"
5$\frac{7}{8}$"
7$\frac{1}{2}$"
9$\frac{5}{8}$"
12"
15$\frac{5}{8}$"
18$\frac{3}{4}$"
23$\frac{1}{2}$"
29$\frac{1}{4}$"
36$\frac{1}{2}$"
STUB 32$\frac{1}{2}$" LONG
(MAY BE FOLDED UNDER ANTENNA)

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Fig. 4

45MC TO 222MC LOG PERIODIC ANTENNA

Figures 2 and 3 at the left give typical horizontal polar diagrams of the all-channel antenna. These responses, plotted in decibels, were made at 57.25 and 144.5MC respectively.

Figure 4, above, shows all necessary details for the construction of the 45MC to 222MC log-periodic dipole antenna. Note that the diameter of the two largest dipoles is ½in compared to 3/8in for the rest of the dipoles. This requires the use of larger insulators for these two dipoles.

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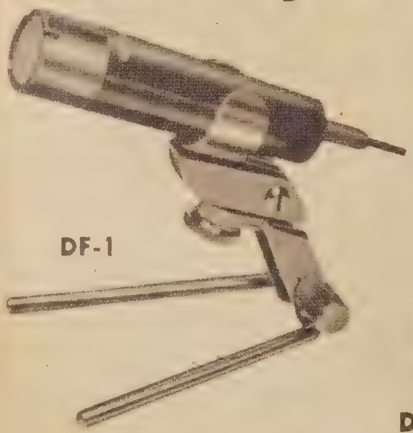
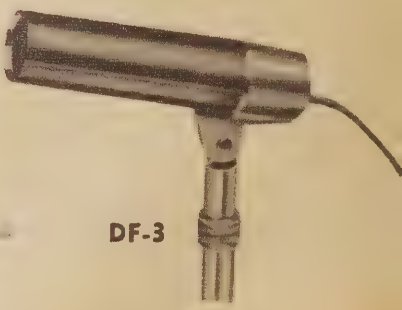


DF-1

DF-2



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front-to-back ratios may be read directly off the chart in decibels.

As we expected from the design data, the gain of the antenna was only moderate but it gave a smooth response over the whole frequency range with only minor variation in feed impedance. With direct feed of 300-ohm transmission line the SWR proved to be better than 2:1 over the entire frequency range. Using a four-to-one TV balun the antenna SWR was better than 1.5:1 over the entire frequency range when fed with 50-ohm coaxial cable.

These figures are quite acceptable for normal TV viewing. This adaptation of the log-periodic dipole antenna thus solves both the mechanical and the electrical problems. The type of construction is certainly more suitable for the average constructor and makes use of available TV antenna "hardware".

Two graphs of horizontal field patterns are reproduced herewith, one showing a typical low band response and the other a response in the 144MC region of the wide band antenna. Although the front-to-back ratio does deteriorate at the low frequency end, the ratio is still high enough for most applications. As may be seen from these graphs, there is very little response to the side of the antenna and, on the higher frequencies, a high front-to-back ratio is exhibited.

In terms of measured performance, the forward gain, referred to a dipole, averaged out at 3.5dB between 45 and 85MC and 5.5dB between 85 and 222MC. The front-to-back ratios measured were as follows: channel 0-7.5dB, 52MC-11.5dB, channel 1-14.5dB, channel 2-13dB, channel 3-18dB, channel 4-11dB; from there on it was well above 20dB, in fact averaging 25.4dB. While the lower channel figures are modest, they are adequate for most primary area TV viewing locations.

In fact, the reduced low frequency performance results from a deliberate compromise aimed at reducing the size of the wide band antenna to acceptable dimensions. In this instance we used a Sigma value below the optimum figure, reducing the boom length considerably, as well as the number of elements required.

It was noticed, by the way, with this antenna and other antennas constructed to the formulas quoted in last month's article, that measured gain, referred to a dipole, was always 2 to 3dB below the gain quoted in the directivity gain chart. This suggests that the chart may have used an isotropic antenna as the reference.

All the dimensions for the wide band antenna are given in the accompanying diagram.

Also included is a table giving dimensions for medium bandwidth antennas, exhibiting higher gain than the wide band antenna, suitable for the various Australian TV channels. These antennas should prove suitable for near-fringe reception and will exhibit good

HIGH GAIN SINGLE CHANNEL LOG PERIODIC DIPOLES. [Dimensions in inches]

CHANNEL	0	1	2	3	4	5	5a	6	7	8	9	10	11	47-54MC	141-148MC
ELEMENT 1	131.2	105.4	93.7	69.5	62.8	58.5	43.1	34.0	32.7	31.4	30.25	28.4	27.5	125.5	41.9
ELEMENT 2	119.4	95.9	85.25	63.9	57.8	54.0	39.9	31.6	30.4	29.2	28.1	26.4	25.6	114.2	38.75
ELEMENT 3	108.6	87.3	77.6	58.8	53.2	50.1	36.9	29.4	28.3	27.2	26.2	24.6	23.8	103.9	35.8
ELEMENT 4	98.9	79.4	70.6	54.1	48.9	46.3	34.1	27.4	26.3	25.25	24.3	22.8	22.1	94.5	33.1
ELEMENT 5	89.9	72.25	64.25	49.8	45.0	42.8	31.5	25.4	24.3	23.5	22.6	21.2	20.6	86.0	30.7
ELEMENT 6	81.9	65.75	58.4	45.8	41.4	39.6	29.2	23.7	22.6	21.9	21.1	19.75	19.1	78.25	28.4
ELEMENT 7	74.5	59.8	53.2	42.1	38.1	36.6	27.0	22.0	21.1	20.3	19.6	18.4	17.8	71.25	26.2
SPACING 1	44.6	35.8	31.9	23.9	21.6	20.25	14.9	11.9	11.5	11.0	10.6	9.9	9.6	42.7	14.5
SPACING 2	40.6	32.6	29.0	22.0	19.9	18.7	13.8	11.1	10.6	10.2	9.9	9.25	8.9	38.8	13.4
SPACING 3	36.9	29.7	26.4	20.2	18.3	17.3	12.75	10.3	9.9	9.5	9.2	8.6	8.3	35.3	12.4
SPACING 4	33.6	27.0	24.0	18.6	16.8	16.0	11.8	9.7	9.2	8.9	8.5	8.0	7.7	32.2	11.5
SPACING 5	30.6	24.6	21.8	17.1	15.5	14.8	10.9	8.9	8.7	8.2	7.9	7.4	7.2	29.25	10.6
SPACING 6	27.8	22.4	19.9	15.8	14.25	13.7	10.1	8.25	8.0	7.7	7.4	6.9	6.7	26.6	9.8
STUB	32.8	26.3	23.4	17.3	15.7	14.6	10.5	8.4	8.1	7.8	7.5	7.1	6.8	31.4	10.4
BOOM, in feet.	20.75	16.75	14.75	11.25	10.25	10.0	7.25	5.75	5.5	5.5	5.25	5.0	4.75	20.0	7.0

Figure 5: This table gives dimensions for medium gain log-periodic dipole antennas for each of the Australian TV channels. Included in the list are dimensions for 52MC and 144MC amateur band antennas. All these antennas are designed for a minimum 7MC bandwidth.

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rejection for co-channel interferen from the side and rear.

A polar diagram of a log-perioc antenna made for channel 8 exhib the type of response that can expected from one of these antennas.

The chart includes design data f two amateur band antennas for t VHF bands. In this case the excelle side and rear rejection properties the antenna can be put to good u in reducing interference on the amate bands.

Digressing for a moment, we mu emphasise that if a wide band anten is used for transmission purposes t transmitter should be free fro harmonic or spurious emissions; shou these fall within the frequency covera of the antenna, they will be radiat with equal efficiency.

Those viewers living in areas cover by the higher frequency TV channe only, 6 to 11 inclusive, are catered f with the design of an antenna to cov all these channels yet still exhibiti much the same gain and characteristi as the single channel versions.

While it would be possible to redu the size of any of these antennas, would result in the deterioration of o or more of its properties such as reduc front-to-back ratio or higher SWR. T designs presented here will cover mo requirements but, for readers who wou like to design their own antennas, suf cient tables and details were given the first part of this article publish in the last issue.

As will be apparent from earlier d cussion, the gain of the log-period dipole antenna is directly related to t number of elements and boom leng At low frequencies high gain desig become too large physically for pra tical construction. However, for fr quencies above 100MC, it becomes pra tical to build a distinctly high-gain lo periodic antenna exhibiting also high front-to-back ratios and higher si rejection. For amateur use on t 144MC, or higher, band this becom an attractive proposition, as these pr perties may be achieved without sac ficing bandwidth.

The same is true of the higher fr quency TV channels and arrays larg than those shown in the table can made for fringe area reception.

Standard stacking arrangements m be used with the single channel antenn to obtain the benefits of stack antennas as described in our rece article on TV reception, Septemb 1965. While stacking bars may be us with the wide band antenna, a co promise would have to be accepted performance. In these cases it is usu to make the stacking distance optimu for one of the more frequently us high-band channels, the stacking distan being typically about 30 inches.

Another approach is to use spec antenna couplers available from T antenna manufacturers. These work a one-way principle, in that a int cepted signal is fed from either or bo antennas into the coupler and on to t feeder. However, if one antenna momentarily not intercepting a sign it will not "suck-out" from the coup the signal being intercepted by the oth antenna. Using this coupler, the aeri may be stacked at the height whi gives the best reception.

One of the properties not previously discussed in relation to the log-periodic is its ability to be designed with a broken frequency progression. For instance, it is possible to design the first few elements to cover a bandwidth of frequencies, jump the next 30 or 40 megacycles and then continue on to cover another band of frequencies. This property allows the size of the aerial to be reduced when separated channels only are required.

As a check of these properties, an antenna was designed to cover TV channels 4 and 8 with a small margin on either side and a wide gap in between. The design, when checked, responded as well as two separate log-periodic antennas, with no detectable interaction between both sections. This was quite a severe test as these two TV channels have a second harmonic relationship, in which standard dual band antenna configurations pose very real problems.

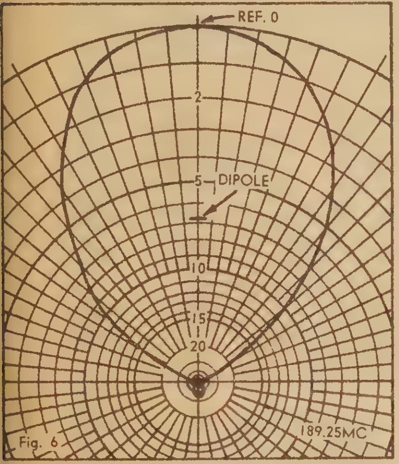

Figure 6: The horizontal polar diagram for a single-channel log-periodic dipole, an example of what may be expected from single-channel antennas made to the dimensions given in figure 5.

We regret that as the number of channel combinations used are quite high, we are not able to give designs for all these combinations. However, the main point to bear in mind, when contemplating the use of log-periodic antennas, is that high gain on the lower frequency channels would involve the use of an impracticable length of boom.

At a later date, if and when UHF FM broadcasting becomes a commercial proposition, there is no reason why a log-periodic antenna cannot be designed for the UHF band, a high-gain design having a boom length of approximately 3½ feet. At these frequencies more than normal attention will have to be given to the selection of a low loss feed-line, however.

The construction of all the antennas described is relatively easy. The boom size will be dictated by the actual size of the array, the larger antennas using 1⅛ to 1¼in diameter aluminium tubing while ¾in to 1in diameter tubing may be used for the very high frequency antennas.

The dipoles are supported by plastic insulators which use single hole mounting. These insulators should be selected for the frequency of the antenna. Antennas embracing frequencies around channels 0 and 1 require ½in diameter elements and the insulators are accordingly bigger than those used for thinner elements. The larger ones could be Antiference type CN1417 or similar.

Higher frequency antennas, with shorter elements, can be made with 3/8in diameter tubing, a suitable insulator being Antiference type CN1175. All these insulators should be mounted on the boom at the spacings given, with due care exercised in drilling the mounting holes in the boom to give proper alignment of all the elements. While a slight misalignment will not affect the performance of the antenna, it can spoil the finished appearance.

HIGH GAIN, HIGH FREQUENCY, MULTI-CHANNEL ANTENNA
Channel 6-11 inclusive (174-222MC)

Element 1	34.0	Element 8	20.5	Spacing 4	9.7
Element 2	31.6	Element 9	19.0	Spacing 5	8.9
Element 3	29.4	Element 10	17.7	Spacing 6	8.25
Element 4	27.4			Spacing 7	7.7
Element 5	25.4	Spacing 1	11.9	Spacing 8	7.2
Element 6	23.7	Spacing 2	11.1	Spacing 9	6.7
Element 7	22.0	Spacing 3	10.3	Stub	8.4

Figure 7: Dimensions, in inches, for a wideband TV antenna covering channels 6 to 11 inclusive.

The phasing harness is not critical and, in our antennas, consisted of 3/16in diameter soft drawn aluminium rod. Our original antennas used a continuous piece of rod with clamps over it which were held in place by the screws passing through the respective elements and insulators. However, there is no special reason why short lengths of rod or tube with ends flattened and drilled could not be used between the various elements.

The end spacings of these harness sections is determined by the insulators used and, where the crossover occurs, adequate spacing should be given to ensure that the harness does not touch under high wind conditions. This spacing is not critical and could be approximately ½ to 1 inch for low frequency regions (longer harness) and ¼in to ½in for the higher frequencies.

In fact, with larger sections of harness used in low frequency antennas, it may be wise to use one or two plastic clip-on insulators to stop sway of the harness.

While it is permissible to have the end stub self-supporting, out behind the longest element, it makes for a neater finish to attach a couple of additional insulators underneath the boom and bend the stub around the end of the boom and on to the insulators.

You will note from our photograph of the wide band antenna that a boom brace is used and we do recommend that this brace or something similar be used for booms exceeding 12 feet.

Unless you are lucky enough to have all the required areas of reception in a straight line it will be necessary to make some arrangement for turning the wide band antenna. This can be simply applied muscle power or some form of antenna rotator. For a discussion of rotators you could refer to our September 1965 article on TV reception. A husky rotator is required for any large antenna, and this includes our wideband unit.

(The larger elements used in the wideband antenna were selected from stock lengths carried by Antiference (Aust.) Pty. Ltd. and elements, insulators and hardware may be obtained from this company for all the antennas described in this article. The company is also willing to manufacture to order any of the antennas described in this article).

In these two articles we have just scratched the surface of the applications of log-periodic antennas and hope that our readers will derive some satisfaction from applying the principles discussed. We also wish to thank Antiference (Aust.) Pty. Ltd. for their assistance in the manufacture and testing of the log-periodic dipole antennas.

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2KM	Kempsey, N.S.W.	‡530	2000
3UL	Warragul, Vic.	‡530	*2000
4QL	Longreach, Qld.	540	10000
7SD	Scottsdale, Tas.	540	2000
2CR	Orange, N.S.W.	550	50000
7BU	Burnie, Tas.	560	500
2ML	Murwillumbah, N.S.W.	560	200
6WA	Wagin, W.A.	560	50000
3WV	Horsham, Vic.	580	50000
4QR	Brisbane, Qld	590	50000
7ZL	Hobart, Tas.	600	10000
4AT	Atherton, Qld.	600	2000
6NM	Northan, W.A.	600	200
2FC	Sydney, N.S.W.	610	50000
3AR	Melbourne, Vic.	620	50000
4QN	Townsville, Qld.	630	50000
7QN	Queenstown, Tas.	630	200
5CK	Port Pirie, S.A.	640	10000
6AL	Albany, W.A.	650	400
8DR	Darwin, N.T.	650	2000
2NU	Tamworth, N.S.W.	650	10000
2BH	Broken Hill, N.S.W.	660	200
6GF	Kalgoorlie, W.A.	660	2000
2CO	Albury, N.S.W.	670	10000
8KN	Katherine, N.T.	670	50
8TC	Tennant Creek, N.T.	680	50
2KP	Kempsey, N.S.W.	680	10000
4KQ	Brisbane, Qld.	690	2000
6WF	Perth, W.A.	690	50000
2NR	Grafton, N.S.W.	700	50000
7NT	Launceston, Tas.	710	10000
†4QW	St. George, Qld.	710	10000
7QT	Queenstown, Tas.	720	500
2TR	Taree, N.S.W.	720	200
4QA	Mackay, Qld.	720	2000
6CA	Carnarvon, W.A.	720	200
5CL	Adelaide, S.A.	730	50000
2BL	Sydney, N.S.W.	740	50000
4QS	Toowomba, Qld.	750	10000
2NB	Broken Hill, N.S.W.	760	1000
2AN	Armidale, N.S.W.	760	50
3LO	Melbourne, Vic.	770	50000
6VA	Albany, W.A.	780	2000
2KA	Katoomba, N.S.W.	780	2000
4TO	Townsville, Qld.	780	2000
4QG	Brisbane, Qld.	790	10000
5RM	Renmark, S.A.	800	2000
9RB	Rabaul, N.G.	810	2000
6WN	Perth, W.A.	810	10000
2BA	Bega, N.S.W.	810	10000
2GL	Glen Innes, N.S.W.	820	10000
3GI	Sale, Vic.	830	10000
6GN	Geraldton, W.A.	830	2000
4RK	Rockhampton, Qld.	840	10000
†6ED	Esperance, W.A.	840	5000
2CY	Canberra, A.C.T.	850	10000
4GR	Toowoomba, Qld.	860	2000
7HO	Hobart, Tas.	860	2000
6AM	Northam, W.A.	860	2000
2GB	Sydney, N.S.W.	870	5000
4WK	Warwick, Qld.	880	*2000
6PR	Perth, W.A.	880	2000
5AN	Adelaide, S.A.	890	10000
2LM	Lismore, N.S.W.	900	*2000
7AD	Devonport, Tas.	900	500
6BY	Bridgetown, W.A.	900	2000
4QB	Maryborough, Qld.	910	2000
4QO	Eidsvold, Qld.	910	10000
2XL	Cooma, N.S.W.	920	*2000
4VL	Charleville, Qld.	920	*2000
6NA	Narrogin, W.A.	920	2000
3UZ	Melbourne, Vic.	930	5000
4QY	Cairns, Qld.	940	2000
7ZR	Hobart, Tas.	940	10000
2UE	Sydney, N.S.W.	950	5000
3BO	Bendigo, Vic.	960	2000
4AY	Ayr, Qld.	960	2000
6TZ	Bunbury, W.A.	960	2000
5DN	Adelaide, S.A.	970	2000
6KG	Kalgoorlie, W.A.	980	2000
2GZ	Orange, N.S.W.	990	2000
3HA	Hamilton, Vic.	1000	2000
6PM	Perth, W.A.	1000	2000
4RO	Rockhampton, Qld.	1000	2000
4CA	Cairns, Qld.	1010	2000
6GE	Geraldton, W.A.	1010	2000
4IP	Ipswich, Qld.	1010	2000
7EX	Launceston, Tas.	1010	2000
2KY	Sydney, N.S.W.	1020	5000
3DB	Melbourne, Vic.	1030	5000
2UH	M'wellbrook, N.S.W.	1040	1000
5PI	Crystal Brook, S.A.	1040	2000
2CA	Canberra, A.C.T.	1050	2000
4SB	Kingaroy, Qld.	1060	2000
2RG	Griffith, N.S.W.	1070	*2000
6WB	Katanning, W.A.	1070	2000
2MO	Gunnedah, N.S.W.	1080	*2000
4MI	Mt. Isa, Qld.	1080	200
6IX	Perth, W.A.	1080	2000
7HT	Hobart, Tas.	1080	2000
3LK	Lubeck, Vic.	1090	2000
4LG	Longreach, Qld.	1100	2000
6MD	Merredin, W.A.	1100	2000
7LA	Launceston, Tas.	1100	2000
2UW	Sydney, N.S.W.	1110	*5000
4BC	Brisbane, Qld.	1120	2000
2AD	Armidale, N.S.W.	1130	2000
6CI	Collie, W.A.	1130	2000
3CS	Colac, Vic.	1130	2000
2HD	Newcastle, N.S.W.	1140	2000
2WG	Wagga Wagga, N.S.W.	1150	2000
4MB	Maryborough, Qld.	1160	2000
5PA	Penola, S.A.	1160	2000
2CH	Sydney, N.S.W.	1170	5000
3KZ	Melbourne, Vic.	1180	5000
2NZ	Inverell, N.S.W.	1190	2000
5KA	Adelaide, S.A.	1200	2000
2GF	Grafton, N.S.W.	1210	2000
6KY	Perth, W.A.	1210	2000
3YB	Warrnambool, Vic.	1210	2000
4AK	Oakey, Qld.	1220	2000
2NC	Newcastle, N.S.W.	1230	10000
3TR	Sale, Vic.	1240	2000
8DN	Darwin, N.T.	1240	2000
2DU	Dubbo, N.S.W.	1250	2000
9PA	Port Moresby, N.G.	1250	2000
3SR	Shepparton, Vic.	1260	2000
2SM	Sydney, N.S.W.	1270	5000
3AW	Melbourne, Vic.	1280	5000
2TM	Tamworth, N.S.W.	1290	2000
4BK	Brisbane, Qld.	1300	2000
5AD	Adelaide, S.A.	1310	2000
3BA	Ballarat, Vic.	1320	2000
4NA	Nambour, Qld.	1320	2000
3SH	Swan Hill, Vic.	1330	2000
4BU	Bundaberg, Qld.	1330	2000
2LF	Young, N.S.W.	1340	2000
3GL	Gelong, Vic.	1350	2000
4GY	Gympie, Qld.	1350	*2000
2NX	Bolwarra, N.S.W.	1360	2000

Continued on next page

5SE	Mount Gambier, S.A.	1370	500
4LM	Mount Isa, Qld. ...	1370	2000
2LT	Lithgow, N.S.W.	1370	500
2GN	Goulburn, N.S.W. ..	1380	2000
4MK	Mackay, Qld.	1380	2000
4BH	Brisbane, Qld.	1390	2000
2PK	Parkes, N.S.W.	1400	2000
2KO	Newcastle, N.S.W. ..	1410	2000
3XY	Melbourne, Vic.	1420	5000
2WL	Wollongong, N.S.W. .	1430	2000
2MW	M'willumbah, N.S.W.	1440	2000
3CV	Maryborough, Vic. ..	1440	2000
5AU	Port Augusta, S.A. ..	1450	2000
2MG	Mudgee, N.S.W.	1450	2000
5MU	Murray Bridge, S.A. .	1460	500
2NM	M'wellbrook, N.S.W .	1460	500
3MA	Mildura, Vic.	1470	2000
2BE	Bega, N.S.W.	1480	1000
4ZR	Roma, Qld.	1480	*2000
2AY	Albury, N.S.W.	1490	2000
2BS	Bathurst, N.S.W.	1500	2000
3AK	Melbourne, Vic.	1500	5000
2NA	Newcastle, N.S.W. ..	1510	10000
2QN	Deniliquin, N.S.W. ...	1520	2000
5LN	Port Lincoln, S.A. ..	1530	200
8AL	Alice Springs, N.T. ..	1530	50
2VM	Moree, N.S.W.	1530	*2000
2CN	Canberra, A.C.T.	1540	2000
†4QD	Emerald, Qld.	1550	50000
2RE	Taree, N.S.W.	1560	*2000
2LG	Lithgow, N.S.W.	1570	200
3WL	Warrnambool, Vic ..	1570	200
4GM	Gympie, Qld.	1570	200
5WM	Woomera, S.A.	1580	50
2WN	Wollongong, N.S.W. .	1580	2000
5MG	Mount Gambier, S.A.	1580	200
4SO	Southport, Qld.	1590	200
5MV	Renmark, S.A.	1590	2000
3NE	Wangaratta, Vic. ...	1600	*2000

* Operates at night or during specified periods on reduced (usually half) power.

† Projected transmitters.

TV CHANNELS & STATIONS

Channel 0 45—52MC.
Channel 1 56—63MC.
Channel 2 63—70MC.
Channel 3 85—92MC.
Channel 4 94—101MC.
Channel 5 101—108MC.
Channel 5A 137—144MC.
Channel 6 174—181MC.
Channel 7 181—188MC.
Channel 8 188—195MC.
Channel 9 195—202MC.
Channel 10 208—215MC.
Channel 11 215—222MC.

A.C.T.

Location	Station	Polarity	Channel
Canberra	ABC (Nat.)	Vert.	3
	CTC (Com.)	Vert.	7

N.S.W.

Sydney	ABN (Nat.)	Hor.	2
	ATN (Com.)	Hor.	7
	TCN (Com.)	Hor.	9
	*TEN (Com.)	Hor.	10
Newcastle	ABHN (Nat.)	Hor.	5
	NBN (Com.)	Hor.	3
Illawarra	ABWN (Nat.)	Hor.	5A
	WIN (Com.)	Hor.	4
Central T'lands	ABCN (Nat.)	Vert.	1
	CBN (Com.)	Vert.	8
Richmond-Tweed	ABRN (Nat.)	Hor.	6
	RTN (Com.)	Hor.	8
Bega	*ABSN (Nat.)	Vert.	0
Broken Hill	*ABLN (Nat.)	Vert.	2
	*BHN (Com.)	Vert.	7
Coffs Harb.	*ABDN (Nat.)	Hor.	2
	NRN (Com.)	Hor.	11
Dubbo	*ABQN (Nat.)	Vert.	3
	CWN (Com.)	Vert.	6
Griffith	*ABGN (Nat.)	Hor.	7
	MTN (Com.)	Hor.	9
Tamworth	*ABUN (Nat.)	Hor.	7
	NEN (Com.)	Hor.	9
Taree	*ABTN (Nat.)	Vert.	1
	*ECN (Com.)	Vert.	8
Wagga	*ABMN (Nat.)	Hor.	0
	RVN (Com.)	Hor.	2

VICTORIA

Melbourne	ATV (Com.)	Hor.	0
	ABV (Nat.)	Hor.	2
	HSV (Com.)	Hor.	7
	GTV (Com.)	Hor.	9
Ballarat	ABRV (Nat.)	Hor.	3
	BTV (Com.)	Hor.	6
Bendigo	ABEV (Nat.)	Vert.	1
	BCV (Com.)	Vert.	8
Latrobe Valley	ABLV (Nat.)	Hor.	4
	GLV (Com.)	Hor.	10
Goulburn Valley	ABGV (Nat.)	Vert.	3
	GMV (Com.)	Vert.	6
Albury	ABAV (Nat.)	Hor.	1
	AMV (Com.)	Hor.	4
Mildura	*ABSV (Nat.)	Hor.	4
	*STV (Com.)	Hor.	8
Swan Hill	ABMV (Nat.)	Vert.	2
	*—— (Com.)	——	10

QUEENSLAND

Brisbane	*TVQ (Com.)	Hor.	0
	ABQ (Nat.)	Hor.	2
	BTQ (Com.)	Hor.	7
	QTQ (Com.)	Hor.	9
Darling Downs	ABDQ (Nat.)	Hor.	3
	DDQ (Com.)	Hor.	10
Rockhampton	ABRQ (Nat.)	Hor.	3
	RTQ (Com.)	Hor.	7
Townsville	ABTQ (Nat.)	Hor.	3
	TNQ (Com.)	Hor.	7
Cairns	*ABNQ (Nat.)	Hor.	9
	*FNQ (Com.)	Hor.	10
Mackay	*ABMQ (Nat.)	Hor.	4
	*MVQ (Com.)	Hor.	6
Maryborough	*ABWQ (Nat.)	Vert.	6
	*WBQ (Com.)	Vert.	8
Warwick	*ABSQ (Nat.)	Hor.	1
	*SDQ (Com.)	Hor.	4

SOUTH AUSTRALIA

Adelaide	ABS (Nat.)	Hor.	2
	ADS (Com.)	Hor.	7
	NWS (Com.)	Hor.	9
	*SAS (Com.)	Hor.	10
Mt. Gambier	*ABGS (Nat.)	Hor.	1
	*SES (Com.)	Hor.	8
Pt. Pirie	*ABNS (Nat.)	Vert.	1
	*—— (Com.)	——	3

WEST AUSTRALIA

Perth	ABW (Nat.)	Hor.	2
	TVW (Com.)	Hor.	7
	*STW (Com.)	Hor.	9
	ABSW (Nat.)	Hor.	5
Bunbury	BTW (Com.)	Hor.	3
Albany	*ABAW (Nat.)	Vert.	2
	*—— (Com.)	——	9
Northam York	*ABCW (Nat.)	Vert.	4
	*—— (Com.)	——	10

TASMANIA

Hobart	ABT (Nat.)	Hor.	2
	TVT (Com.)	Hor.	6
Launceston	ABNT (Nat.)	Hor.	3
	TNT (Com.)	Hor.	9

* Not yet in operation.

Aust. TV, shortwave services continued overleaf

WARBURTON FRANKI
After Stocktaking BARGAINS

MICROPHONES
Australian-made Crystal. Hand held type supplied in box with stand adaptor and 8½ feet cable.

£1 or $2 Post Free

FAMOUS ITALIAN GELOSO CRYSTAL
Will fit Australian type Mic. Stands. Attractive white plastic case and supplied in box with 7½ feet cable and phone plug.

£2/10/0 or $5 (Post Free)

IMPORTED DYNAMIC
Egg-shaped with built-in stand—Hi-Impedance—supplied in box with 5½ feet cable.

35/- or $3.50
(Post Free)

IMPORTED LAPEL CRYSTAL
C/w lead and plug.

12/6 or $1.25
(Post Free)

GANGED POTENTIOMETERS
20K Log plus 20K log.
25K Linear plus 25K Linear.
100K Log plus 100K Log.

5/- each or 50c. (Post Free)

PICK UP ARM
Complete with turnover Crystal Cartridge.

25/- or $2.50 (Post Free)

PICTURE TUBE BOOSTERS
Give your picture tube a new lease of life by installing an easily fitted booster. If your picture lacks contrast and brightness you need a picture tube booster. When ordering, state whether 70, 90 or 110 degrees, or the type number of the tube.

70 deg. and 90 deg. type, 35/ or $3.50
110 deg. type .. .. . 38/6 or $3.85
(Post Free)

MULTIMETERS
Well-known type 200H. Fan-shaped meter movement.

Ranges:—
D.C. Volts: 5, 25, 50, 250, 500, 2,500 at 20,000 o.p.v.
A.C. Volts: 10, 50, 100, 500, 1,000 at 10,000 o.p.v.
D.C. Current: 50 U.A., 2.5 M.A., 250 M.A.
Resistance: .6K, .6 megohm.
Capacitance: 10 PF to .1 MFD.
Decibels: Minus 20 to plus 22.
Supplied in box with leads and battery

£5/10/0 or $11 (Post Free)

RECORD CLEANER KITS
Mounts on Turntable and tracks in front of the stylus, removing dust, etc

35/- or $3.50 (Post Free)

GUTTER GRIP CAR AERIALS
Australian made — Supplied c/w lead and plug to suit most Transistor Radios.

37/6 or $3.75 (Post Free)

PICKUP CARTRIDGES
Ronette Monaural with **Diamond** L.P. Stylus and Sapphire Std. 78 Stylus.

59/6 or $5.95 (Post Free)

SIGNAL GENERATORS
FAMOUS LEADER LSG11

£15 ($30)
(Including tax and freight.)

The LEADER LSG-11 is a general purpose signal generator having features which make it most useful in testing, checking and experimenting with radio and audio frequency circuits. Calibration accuracy is plus-minus 1% below 30Mc and plus-minus 3% to 390Mc. This feature permits easy alignment and checking of tuned circuits, IF amplifiers, etc.

Wide frequency range: 120 Kc to 390 Mc, Stable Colpitts oscillator with buffer stage. Two audio modulation frequencies. Provision for quartz crystal. Clear scales for frequency calibation. Compact and rugged construction. Attractive heavy steel cabinet.

SPECIFICATIONS:

Frequency Range	**120KC-130Mc on fundamentals.**
Calibrated Harmonics	**120-390Mc.**
R.F. Output	**0-100,000uV, adjustable (120Kc-30Mc).**
Modulation Frequencies	**400 and 1,000cps, A.F. Output adjustable.**
Crystal Oscillator	**1 Mc to 15 MS.**
Tube Complement	**1-12BH7 1-6AR5.**
Accessory	**1-75ohm Cable.**
Power Supply	**AC 50/60 cps.; 100V, 115V or 230V as specified; 13VA approx.**
Size and Weight	**27.5 x 19 x 11.5cm; 2.75 kg (6.1lb) 10¼in x 7½in x 4½in).**

GELOSO COIL KITS
MODEL 2676 — 5 BANDS — COVER FROM 520Kc to 18.5Mc. You get. ● Wired Coil Bracket and Switch ● Pair 455Kc IF Transformers ● Two-Gang Tuning Condenser with built-in Trimmers ● Complete Dial Assembly with Calibrated Dial Glass 3¾in x 4¼in. ● Descriptive Leaflet with Circuit.

£7/10/- ($15) Inc. Pack and Post.

WORLD FAMOUS POLYPACS
1 Dollar (10/-)

Famous one-dollar paks—brand new—no "rubbish."
Ideal for amateurs, beginners, servicemen, enthusiasts.

1. 30 carbon resistors, asst. ½-watt and 1 watt, presets, too. **One dollar (10/-).**
2. 20 asst. capacitors. 5 each paper, plastic, mica, ceramic. **One dollar (10/).**
3. 20 silver mica capacitors, inc. 5 per cent values. **One dollar (10/).**
4. 20 styroseal plastic capacitors, 20 per cent and 10 per cent. **One dollar (10/).**

Guaranteed A1 quality. Popular brands.
1 pak, postage 5d; 3 paks, post free.

MAGNAVOX SPEAKERS
All Models Available from Stock —
Write or call for Data Sheet.
HF5SIC Tweeter — 7.5 or 15 Ohm **52/- ($5.20)**
6WR 7.5 or 15 Ohm **£6/11/6 ($13.15)**
8WR 2.7 or 15 Ohm **£7/2/6 ($14.25)**
12WR 2.7 or 15 Ohm **£7/12/6 ($15.25)**
POST FREE

CRYSTAL DIODE RADIOS
Boxed with Earplug and Aerial Lead. 19/11 ($1.99).
Plus Pack and Post 6d (5c).

TELECOMPONENTS
W.F. have been appointed distributors of the well-known range of "Telecomponents" Television and Radio Transformers. Full stocks available.

WARBURTON FRANKI

ALBERT RD
KINGSWAY
DOMAIN RD
PARK ST
SHRINE
ST KILDA RD
KINGSWAY
3/4 MILE TO CITY
CLARENDON ST
COVENTRY ST
W.F.

220 PARK ST., STH. MELB., VIC. - - 69-0151

● *Please include postage and freight with all orders.* ● *Trade also supplied*

NEW ZEALAND RADIO, TELEVISION

M/W BROADCAST STATIONS

Call	Location	Frequency (KC)	Authorised Power Watts
2YA	Wellington	570	10000
2YZ	Napier	630	5000
4YX	Alexandra	640	2000
2YC	Wellington	660	60000
3YA	Christchurch	690	20000
4YZ	Invercargill	720	20000
3ZA	Greymouth	750	2000
1YA	Auckland	760	20000
4YA	Dunedin	780	20000
2YB	Wellington	800	20000
4ZA	Invercargill	820	10000
2XB	Masterton	840	2000
1YZ	Rotorua	860	10000
1YC	Auckland	880	10000
4YC	Dunedin	900	10000
3YZ	Greymouth	920	10000
2ZA	Palmerston North	940	2000
3YC	Christchurch	960	10000
1XN	Whangarei	970	2000
2ZB	Wellington	980	20000
1ZD	Tauranga	1000	10000
4ZB	Dunedin	1040	10000
2XG	Gisborne	1060	2000
1ZB	Auckland	1070	10000
3ZB	Christchurch	1100	10000
2YD	Wellington	1130	2000
1YW	Hamilton	1140	2000
3XC	Timaru	1160	2000
2YW	Gisborne	1180	2000
2XA	Wanganui	1200	2000
1XE	Kaikohe	1220	2000
1YD	Auckland	1250	2000
2ZC	Hawkes Bay	1280	2000
1XH	Hamilton	1310	2000
2XN	Nelson	1340	2000
1ZC	Rotorua	1350	2000
2XP	New Plymouth	1370	2000
3YD	Christchurch	1400	2000
4XD	Dunedin	1430	250
1XA	Kaitia	1440	2000
3YW	Westport	1460	2000
*1ZO	Tokoroa	1480	1000
1ZA	Taupo	1500	2000
*1ZU	Taumarunui	1520	1000
2ZE	Blenheim	1540	1000
2ZH	Hawera	1560	1000

* Due to open shortly.

TV CHANNELS & STATIONS

Channel 1	44-51 MC	Channel 6	188-195 MC
Channel 2	54-61 MC	Channel 7	195-202 MC
Channel 3	61-68 MC	Channel 8	202-209 MC
Channel 4	174-181 MC	Channel 9	209-216 MC
Channel 5	181-188 MC		

Wellington	WNTV-1	1
Mt. Te Aroha (Waikato)	AKTV-2*	1
Hedgehope (Invercargill)	DNTV-2*	1
Auckland	AKTV-2	1
Dunedin	DNTV-2	2
Wharite	WNTV-1*	2
Christchurch	CHTV-3	3
Kuriwao	DNTV-2*	5
Mt. Erin	WNTV-1*	6
Blenheim	WNTV-1*	6
Whangarei	AKTV-2*	6
Timaru	CHTV-3*	6
Masterton	WNTV-1*	7

* Repeater Stations

SHORT-WAVE — RADIO NEW ZEALAND

Radio New Zealand, Wellington, uses two 7,500-watt transmitters and carries programs from the Home Service from 1700-0545. From 0600-0845 it has a special program to the Pacific and, from 0900-1145, it is beamed to Australia. The station has the following frequencies and calls assigned.

ZL20	6020 KC	ZL3	11780 KC
ZL7	6080 KC	ZL21	15110 KC
ZL2	9540 KC	ZL4	15280 KC

AUSTRALIAN SERVICES — Cont.

TV STATIONS & CHANNELS

THE Australian Broadcasting Control Board has approved establishment of the following television translator stations, for the relaying of commercial or national programs.

Area to be served	Parent Station	Channel
Khancoban, N.S.W.	AMV-4	10
Snowy Mts., N.S.W.	AMV-4	6
Lithgow, N.S.W.	ABCN-1 CBN-8	5 6
Mudgee, N.S.W.	CBN-8	11
Kyogle, N.S.W.	ABRN-6 RTN-8	3 5
Bonalbo, N.S.W.	RTN-8	5
Warrnambool-Port Fairy, Vic.	ABRV-3 BTV-6	2 9
Queenstown-Zeehan, Tas.	ABT-2 TVT-6	4 8
Rosebery-Renison Bell, Tas.	ABV-2 TVT-6	1 10
Taroona, Tas.	TVT-6	8
Swansea-Bicheno, Tas.	TVT-6	8
Smithton-Stanley, Tas.	ABNT-3 TNT-9	1 6
Gowrie Park, Tas.	TNT-9	1

SHORT-WAVE SERVICES

THE following stations provide a domestic and overseas service in the 49, 42, 31, 25, 19, 16, 13 and 11 metre bands:

Call Sign	Location	Power (watts)
VLG	Melbourne, Victoria	10,000
VLH	Melbourne, Victoria	10,000
VLI	Sydney, N.S.W.	2,000
VLK	Port Moresby, Papua	10,000
VLM	Brisbane, Queensland	10,000
VLQ	Brisbane, Queensland	10,000
VLR	Melbourne, Victoria	10,000
VLT	Port Moresby, Papua	10,000
VLW	Perth, Western Australia	10,000
VLX	Perth, Western Australia	50,000

TRANSMITTERS for the overseas service of Radio Australia are located at Shepparton, Victoria. They comprise four 100,000-watt transmitters, two 50,000-watt transmitters and one 10,000-watt transmitter. A 10,000-watt transmitter at Lyndhurst, Victoria, is also used on occasions. These use a variety of frequencies and aerials as required to give best reception in the selected areas.

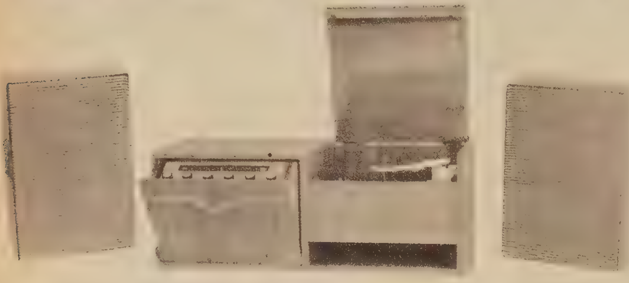
"ELECTRONICS Australia" does not publish, nor do we have available, list of overseas stations, frequencies, broadcast times, etc.

The only information of this type is as compiled by our DX correspondent, Mr Art Cushen, and published each month on "Listening Around The World" page.

For general information on shortwave and other stations, reference can be made to the "World Radio Handbook,' available through most large technical booksellers.

NEW *Releases!*

NEW PLAYMASTER 4 AMPLIFIER with TUNER



COMPLETE STEREO SYSTEM

- Playmaster 4 amp with tuner.
- Garrard Autoslim Changer.
- 2 Playmaster Bookshelf Speakers.
- Control Cabinet as illustrated. in Maple, Rosewood, or Walnut.

Teak 70/ extra. Legs for Control Cabinet if required, 25/ extra.

£108 Freight and packing extra.

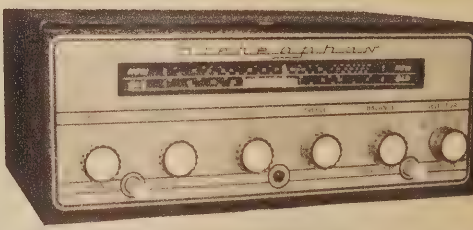
- Output 8 Watt per Channel (16 Watts).
- Ferguson O.P.412 Oriented Grain Output Transformers with a frequency response of 20 to 30,000 cycles.
- Inbuilt Tuner with EM84 Tuning Indicator, Calibrated Dial Scales.
  Available for all States.
- Valves 4-6GW8, 12Au7, 6N8, 6AN7, EM84 and 2-210 Rectifiers.
- Switching and Input Facilities for Pick-up and Tape Recorder (Stereo or Mono).
- Supplied in self-contained case finished in grey baked enamel with Control Panel in black and silver with matching knobs.
- Fully Guaranteed.

AMPLIFIER and TUNER

£46/15/- Plus Freight

Amplifier and Tuner supplied with two Magnavox 8WR or Rola 8MX speakers and Garrard Autoslim record changer.

£63/15/- F.O.R.



THE NEW PLAYMASTER BOOKSHELF LOUD SPEAKER SYSTEM

— AS FEATURED IN DECEMBER ISSUE OF RADIO AND HOBBIES

CABINET DIMENSIONS 18" x 12" x 7"

This provides the ideal speaker combination, where space is limited, for use with any of the amplifier units listed on the opposite page.

Complete kit of parts for cabinet including silk and innabond padding, 6WR Magnavox and Rola 5FX speakers. 100 ohm variable res., 4mfd. condenser and inductance.

£12/10/- Post and packing extra.
N.S.W. 15/- Vic., Qld., Tas. 22/- W.A. and S.A. 30/-

Unit built polished and wired in Rosewood, Maple or Walnut. — Teak finish 10/- extra. **£15/-/-**

Complete kit of parts less cabinet but including speaker, condenser, resister, inductance, innabond padding and speaker silk. **£8/15/-**
Post and packaging 12/6 extra.

The above speaker system now available with Magnavox 8WR or Rola 8MX speakers in place of the 6WR, as featured in September Electronics Australia.

Cabinet dimensions 21½ x 13¾ x 8½.
Unit built, polished and wired in Rosewood Maple or Walnut—teak 15/ extra.

£17/10/- Freight extra.

Complete kit of parts less cabinet but including speakers, condenser, resister, inductance, innabond padding and speaker silk.

£9/15/- Post and packing, 15/ extra.

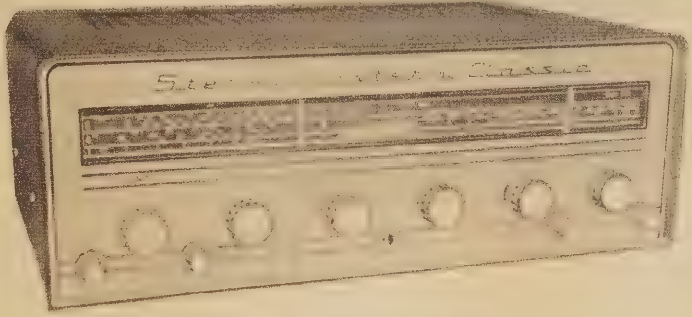
CLASSIC RADIO

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE 71-2145

IN HI-FI STEREO EQUIPMENT BY CLASSIC

Based on Radio & Hobbies Playmaster No. 4 and Playmaster 101 Amplifiers. Both units have built in dual wave tuners.

WRITE FOR FULL SPECIFICATIONS



ALL UNITS FULLY GUARANTEED

SPECIFICATIONS COMMON TO BOTH UNITS:

● Inbuilt high gain dual wave tuner with a frequency coverage of 550 to 1,600 K.C. on the broadcast band and 16 to 49 metres on short wave. ● EM84 tuning indicator giving accurate tuning with ease. Two channel tone control stage with separate bass and treble controls. ● Input facilities with switching for external tuner—stereo pick-up—stereo or mono tape recorder for recording or play back. ● Stereo reverse switch. ● Calibrated dial scales available for all States showing main stations in large type with separate scale for short wave using two dial pointers. ● Chassis is mounted in attractive and durable metal case finished in grey with embossed control panel in black and silver with matching knobs.

PLAYMASTER 4 UNIT

WITH TUNER

- Output 8 watts per channel (16) watts.
- Incorporating Ferguson grain oriented output transformers giving response of 20 to 30,000 cycles.
- Valves, 4 6GW8, 12AU 7, 6N8, 6AN7, EM84, and two IN1763 rectifiers.

AMPLIFIER AND TUNER £52/15/-, WITH GARRARD AUTOSLIM STEREO CHANGER AND TWO MAGNAVOX 8WR SPEAKERS.

£69/10/-

PLAYMASTER 101 UNIT

WITH TUNER

- Output 12 watts per channel (24 watts).
- Incorporating Ferguson grain oriented output transformers giving a frequency response of 20 to 30,000 cycles.
- Valves 4 6GW8, 12AX7, 6N8, 6AN7, EM84 and two 210 rectifiers.

AMPLIFIER AND TUNER £56/10/-, WITH GARRARD AT5 STEREO CHANGER AND TWO ROLA 12PX SPEAKERS, £79/10/.

ALL PRICES F.O.R. SYDNEY

PLAYMASTER AMPLIFIERS LESS TUNERS

SPECIFICATIONS AS ABOVE (AMPLIFIER ONLY)

101 UNIT £45/10/- No. 4 UNIT £42/-/-

ALL PRICES F.O.R. SYDNEY.

All Amplifiers are as above Illustration.

PIONEER SM—B161—STEREO AMPLIFIER

WITH TWO A.M. AND S.W. TUNER

- 14 VALVES PLUS 2 DIODES.
- UNDISTORTED OUTPUT 11w x 2 (American ratings).
- RESPONSE 20 cps. to 30Kc.
- INPUT GAIN, MAG. PICK-UP 2mv CRYSTAL 3mv.
- TWO A.M. TUNERS 535 to 1605 K.C.
- SHORT WAVE TUNER 3.8 to 12 Mc.
- TUNING INDICATORS COMMON TO BOTH D.C. and S.W.
- TONE CONTROLS. SEPARATE BASS AND TREBLE CONTROLS.
- LOUDNESS CONTROL.

PLUS DUAL 1010 Changer and Two 8" GOODMAN SPEAKERS

99gns. F.O.R. SYDNEY.

CLASSIC RADIO

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE 71-2145

Homecrafts PTY LTD

AUSTRALIA'S LARGEST Radio, Television and Hobbies SPECIALISTS

307 ELIZABETH STREET, MELBOURNE—60-1442.

★ We have everything for the Radio Hobbyist ★

MODEL 200H

20,000 Ohms per Volt DC 10,000 Ohms per Volt AC.

Specifications:

DC Volt: 0-5, 0-25, 0-50, 0-250, 0-500, 0-2.500.

AC Volt: 0-10. 0-50, 0-100, 0-500, 0-1,000

DC Current: 0-50, Micro-amps res 0-25, 0-250 Milliamperes.

Resistance: 0-60K Ohms, 0-6 Meg Ohms.

Capacity: 0-01-0.3mfd (at AC 5 volt 0.0001-01mfd at AC 250 Volt).

Decibel: minus 20db plus 22db.
Output Range: 0-10, 0-50, 0-100, 0-500, 0-1,000
Battery used: UM-3-1, 1 piece.
Dimensions: 3¼in x 4½in x 1⅛in.
Complete with internal battery, testing leads and prods.

PRICE: £5/10/-

Including Sales Tax

Plus Postage 3/6.

TRANSISTORISED CALLING & TALKBACK SYSTEMS

BATTERY OPERATED

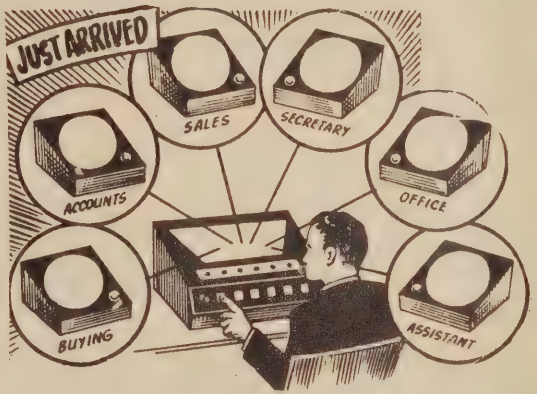


TABLE OR WALL MOUNTING

2 Station 1 Master 1 Sub-stations 1 x 9V Batts., **£7/17/6.**
3 Station 1 Master 2 Sub-stations 4 x 1½V Batts., from **£9.**
4 Station 1 Master 3 Sub-stations 6 x 1½V Batt.s from **£12.**
5 Station 1 Master 4 Sub-stations 6 x 1½V Batts., **£22/7/9.**
7 Station 1 Master 6 Sub-stations 6 x 1½V Batts., **£27.**

Plus Postage.

MODEL TP-5S

- High sensitivity-20,000 Ohms/V DC, 10,000 Ohms/V AC.
- 3in Meter.
- Handy pocketable size.

Specifications:

DC Voltages: 0-10-50-250-500-1,000 V (20,000 Ohms/V).
AC Voltages: 0-10-50-250-500-1,000 V (10,000 Ohms/V).
DC Current: 0-50uA, 0-5-50-500mA.
Resistance: 0-10K, 0-100K, 0-1 Meg, 0-10-Meg. (62 Ohms. 620 Ohms. 6.2K, 62K at centre scale.)
Capacitance: 0.0001uF-0.005-uF, 005uF-1uF
Decibels: minus 20db to plus 36db in 2 ranges.
Dimensions: 3½in x 5¼in x 1⅜in.
Weight: 15oz approx.
Complete with internal battery, testing leads with prods.

PRICE: £9

including Sales Tax.
Plus Postage 3/6.

Capacitor Substitution Box, 1000 VW **35/-**

Resistor Substitution Box, 1 Watt, 45/

TRANSISTOR AERIALS

4in extends to 27in	**15/**
5in extends to 39in	**17/**
6in extends to 43in	**14/**
6in extends to 32in	**10/**
6in extends to 28in	**9/6**
7in extends to 39in	**16/**
9in extends to 39in	**14/**
10in extends to 39in	**9/6**

Plus postage 1/6.

SPECIAL XMAS PURCHASE

Morse Keys **24/**

Coin in slot boxes up to 8 hrs. for 2/-

Switch up to 5 amps. **£4/10/.** Plus 5/ postage.

LMI Crystal Mic. with 3.5mm plug. **10/.** Post free.

Crystal and Magnetic Earphones, 2.5mm plug, **5/.** Post free.

3in ext. speaker in plastic box with soft lead, **29/6.** Plus postage 2/6.

6-9V min. relays 500 ohm, **10/** ea. Post free.

Trans. Pri. 220, 240, 250, Sec. 218V Doubler at 270mA, 6.3V at 8 amps. **25/.** Plus postage 10/.

Trans. Pri. 200, 220, 250. Sec. 275-275 at 80mA. 6.3V at 5A. **25/.** Plus postage 10/.

Slide Rule Calculators, add, subtract, etc. to six figures. **6/6 ea.** Post free.

Spiral indoor TV Antenna, **19/6.** Plus postage 5/.

3AG Fuses 1 amp. **1/** pkt. of 5.
3AG Fuses 5 amps. **1/6** pkt. of 5.
3AG Fuses 10 amps. **1/6** pkt. of 5.

CRYSTAL SET BUILDERS

Coils	**6/-**
Diodes	**3/-**
Headphones	**25/-**
Tuning Conds.	**16/6**
Terms.	**1/- ea.**

1 Trans. Amplifier for crystal set circuit supplied.

Only 19/6

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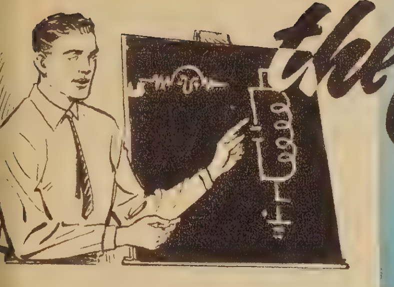

the "Answer Man" Explains

Valve Type Numbers

Like the flowers that bloom in the spring, the Answer Man has been faced with the perennial question about valve numbers — what clue do they give to the characteristics of the particular valve? And, for that matter, what about transistor type numbering systems?

I have several valves in my possession and have wondered whether the type numbers can be used to determine the type of valve without reference to a valve data book.

To a certain degree valve types may be identified by their numbering. Several systems have been evolved, but the main two are referred to as the European and American series. For our readers' benefit we are listing here the code used in both systems.

The present European system consists of a number of capital letters followed by either one or two figures (e.g., EBC3, EL33). The first letter indicates the filament or heater rating, while the remaining letters give the type classification. The figures indicate both individual type identification and the valve base and/or type of valve construction used. In some cases a letter suffix is used to indicate a minor constructional change (e.g., EL33—EL33A). The key to this system is given in the following tables:

First letter (filament or heater ratings)

A—4V AC type.
B—180mA DC type.
C—200mA AC/DC type.
D—Battery types up to 1.4V DC.
E—6.3V AC type.
F—13V car radio type.
G—5V AC type.
K—2V battery type.
P—300mA AC/DC type.
U—100mA AC/DC type.
V—50mA AC/DC type.

Valves using the first letter sequence of B and F were released in the U.S.A. only and are not usually encountered in Australia. The odd valves encountered with a single alphabetic prefix of B or F were numbered prior to the adoption of this system and cannot be related to the code.

Second and subsequent letters (type classification)

A—Single diode.
B—Double diode.
C—Triodes except output triodes.
D—Output triodes.
E—Tetrode.
F—Pentodes except output pentodes.
H—Hexode or Heptode.
K—Octode.
L—Output pentode.
M—Tuning indicator.
P—Secondary emission valve.
W—Half wave gas-filled rectifier.
X—Full-wave gas-filled rectifier.
Y—Half wave high-vacuum rectifier.
Z—Full-wave high-vacuum rectifier.

Number sequence

1-10 Pinch type construction valves fitted with European 5-pin ("V"), 8-pin ("P") side contact bases, or international octal bases, and using European basing connection sequence.
11-19 European type metal valves and glass valves fitted with European metal bases.
20-29 All-glass valves fitted with 8-pin Loktal type American bases.
30-39 Pinch type construction valves fitted with international octal bases and using American basing connection sequence.
40-49 All-glass miniature valves fitted with 8-pin Rimlock base.
50-59 Special construction types fitted with bases applicable to design features used.
60-64 All-glass valves fitted with 9-pin base (other than "Noval").
65-79 Sub-miniature all-glass valves with or without bases.
80-89 All-glass miniature valves fitted with 9-pin American "Noval" type base.
90-99 All-glass miniature valves fitted with 7-pin American "Button" type base.

There are a few exceptions to this code.

The present American system consists of a number sequence followed by either one or two capital letters and a further number and, in some cases, a letter sequence suffix (e.g., 25L6GT).

The first number sequence is indicative of the filament or heater voltage. The first letter sequence is purely individual type identification without reference to classification. The second number represents the number of effective electrodes to which external connection is possible. The letter sequence suffix is indicative of type of construction. The following tables give the key to this system.

First figure sequence

0—Cold cathode types.
1—1.4V and 2V battery types.
2—2.5C AC types.
3—2.8V battery types (centre tapped filament for either 1.4V or 2.8V operation).
5—5V AC types.
6—6.3V AC types.
7—7.0V AC types (all-glass, Loktal base), nominal operating heater voltage 6.3V.
12—12.6V AC/DC types (in some cases centre tapped heaters for either 6.3V or 12.6V operation).
14—14.0V AC/DC types (all-glass, Loktal base), normal operating heater voltage 12.6V.
15 and above—Heater voltage to nearest indicated volt.

First letter sequence

Type identification without reference to application except that in the case of two-letter sequences commencing with the letter "S" a single-ended construction is indicated (e.g., 6SK7GT).

2nd Figure Sequence

Indicates the number of effective electrodes to which external connection can be made. Internally connected electrodes are disregarded. There have been many exceptions to this section of the system in the past.

2nd Letter Sequence

The use of a suffix has developed generally as a result of the adaption of an existing type to a different construction either physically or electrically.

The most common suffixes are G, GT, and A. The first two refer to the construction of the valve envelope, there being no electrical difference in the two valves. The suffix A indicates a controlled warm-up time for the heater and was introduced when it became a common practice to connect a string of valves in a series heater arrangement, especially for TV receivers.

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Input Impedance (Typical)	1.5K	1K	2.5K	220K	1.5K	1.5K
Load Resistance (Ohms)	40	15	15	15	3	8
Supply Voltage (Nominal)	9V	9V	9V	9V	12V	9V
Total Distortion (Full output)	6%	6%	6%	6%	3%	3%
Frequency Response	330 c/s —15Kc/s	200 c/s —12Kc/s	200 c/s —12Kc/s	200 c/s —12Kc/s	50 c/s —15Kc/s	50 c/s —15Kc/s
Overall Dimensions (Inches) All ¾in. high.	2 x 1	2½ x 1½	2½ x 1½	2½ x 1½	5½ x 1¾	3 x 1¾
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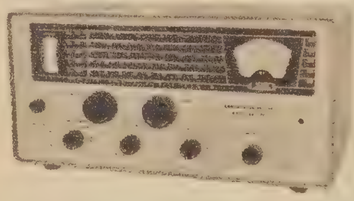

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Band 1	540-1605 KC
Band 2	1.6-4.8 MC
Band 3	4.8-14.5 MC
Band 4	10.5-30 MC

BAND SPREAD:

3.5 MC Band	3.5-3.575 MC
7 MC Band	7.0-7.14 MC
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21 MC Band	21.0-21.9 MC
28 MC Band	28.0-30.2 MC

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SELECTIVITY:—60 dB at ± 7 KC detuning.
SENSITIVITY: 3 μA (S/N 20 dB at 10 MC)
TUBE COMPLEMENTS: 6BA6 x 4, 6BE6 x 1, 6AL5 x 1, 12AT7 x 1, 6AR5 x 1, 5Y3GT x 1.
SIZE: 17" (W) x 8½" (H) x 10-3/4" (D)
WEIGHT: 26 lbs.

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If a comprehensive system is used for valve identification does this also extend to semi-conductors?

The type numbering system used for designating semi-conductors in America follows essentially the principle used for receiving valves. The system consists of a figure preceding the letter "N" and followed by a figure group (e.g. 1N54, 2N109).

The key to this system is given below:

First Figure

1. 2 elements (equivalent to a valve diode).
2. 3 elements (equivalent to valve triode), etc.

First Letter

N. Semi-conductor.

Figure Group

This indicates a particular design.

European System

Prior to 1960, the European semi-conductor type numbering system also followed the principle used for receiving valves on that continent. However, since that date, a new system has been introduced by the major manufacturers.

The old system, following the valve type numbering principle, consisted of a two-letter prefix followed by a figure group (e.g. OA79, OC26). The key to this system is given below:

First Letter

O. Heaterless device.

Second Letter

A. 2 element device (equivalent to a valve diode).
C. 3 element device (equivalent to a valve triode).

Figure Group

This indicates a particular design.

In the new system type numbers of semi-conductors manufactured for entertainment use, consist of two letters and three figures (e.g. AF114, BY100), while professional/industrial types consist of three letters and two figures (e.g. AFY19). The first letter indicates the material from which the semi-conductor is constructed. The second letter describes the semi-conductor type.

First Letter

A. Germanium.
B. Silicon.

Second Letter

A. Diode (including voltage dependent capacitor).
C. Low frequency transistor having $K > .015$°C/mW.
D. Low frequency power transistor having $K < 0.015$°C/mW.
E. Tunnel diode.
F. High frequency transistor.
L. High frequency power transistor.
P. Photo semi-conductor.
S. Switching transistor.
T. Controlled rectifier, thyristor or Shockley diode.
U. Power switching transistor.
Y. Power diode (rectifier).
Z. Reference or Zener diode.

Third Letter

Used for professional types only, and has no other significance.

Figure Group

This indicates a particular design.

Regarding the use of a dry reed switch in an implanted pacemaker (August, 1965) is not this application fraught with danger? Would there not be a risk that the switch would be accidentally activated by electrical or magnetic equipment, such as radios, TV sets, cars, motors, generators, etc. If this is a hazard, could it be avoided by the patient wearing a metal shield over the upper half of his body, trailing an earth wire along the ground?

Fortunately, the answer to both halves of this question is, no. There is no such hazard and no such cumbersome protection would be needed or, indeed, would work if the hazard existed. It requires a very strong magnetic field to operate one of these switches at a distance of more than a fraction of an inch. The magnet quoted in the article was quite a strong one (it would lift nearly half a pound) yet it needed to be within 3/8in to operate the switch. When used in a pacemaker, a much larger and stronger magnet than this is needed to bridge the gap of one or two inches between the outside of the patient's body and pacemaker within it.

Thus, in practice, it would be almost impossible to find a magnetic field of sufficient strength to operate the switch, particularly from the random sources suggested. Even if a particular component produced a field of comparable strength to that of the magnet, the patient's body would have to be in virtual contact with it, and at the precise spot immediately opposite the pacemaker, before any reaction would occur. The chances of such a circumstance are so remote as to be negligible.

In the light of the above it becomes obvious that the patient needs no Ned Kelly-like suit of armour—with earth wire—to protect him from such stray fields. However, the suggestion that this could be done, if necessary, makes one suspect that the reader is not quite "with it" when it comes to the fine distinction between electromagnetic and electrostatic fields. The former is one which would operate the reed switch (if it was strong enough) and the latter is the one that we normally control with a simple metallic earthed shield.

Magnetic fields are not so easily shielded. Magnetic material must be used and it needs to have a high permeability or be physically very thick or sometimes both. ■

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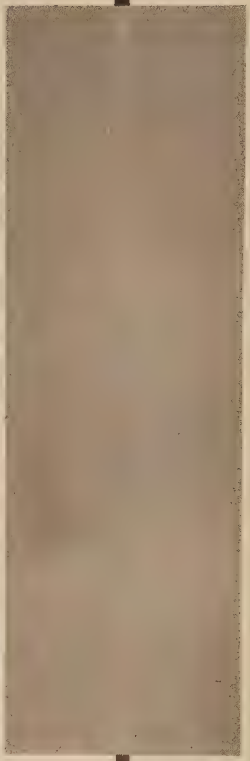

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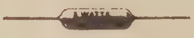
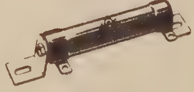
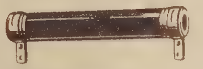
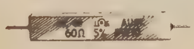
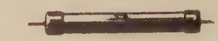
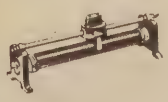
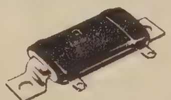
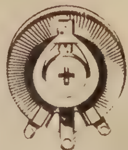
 Vitreous coated Wire wound 1.5 to 14 watts. Bulletin RWV.621A	 Tubular, fixed and adjustable Wire wound 3 to 200 watts with "Pyrosil" coating. Bulletin PRS.62A	 High voltage and High frequency Resistors up to 100 kV, 90 watts. Lead, lug and ferrule types. Bulletin MPMV62A
 Ceramic case Wire wound Fireproof inorganic construction 5 to 15 watts. Bulletin PW.2	 Power Film High Reliabiltiy Mechanically rugged 4 to 7 watts. Bulletin PF64AE-1	 Glass insulated Wire wound Silicone impregnated glass fibre core 6-9 watts per inch. Reference: Type AW
 Sliders Wire wound 50 to 200 watts. Bulletin SLS.62A	 Flat Wire wound with "Pyrosil" coating 20 to 75 watts. Bulletin FRW(a)	 Variable Wire wound 2 to 100 watts. Bulletin PRA65A

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THESE were exactly the conditions under which I encountered what must be one of the most unusual faults I have struck for a long time, and one which really had me scratching for a while. What looked like a quite routine fault in the sound section of TV set turned out to be a classic case of symptoms pointing anywhere but in the right direction.

The customer had complained of a very poor picture; shrunken, lacking contrast, marred by wriggly lines, and generally doing all things it shouldn't. Having lugged a heavy tool kit from the truck and up three flights—on a hot day—I was hoping fervently that it didn't turn out to be a curly one. Quite apart from the normal problems of tracking down difficult jobs in the customer's home, I didn't relish the prospect of trotting back and forth to the truck for various spares which invariably turn out to be the ones you don't have in your kit.

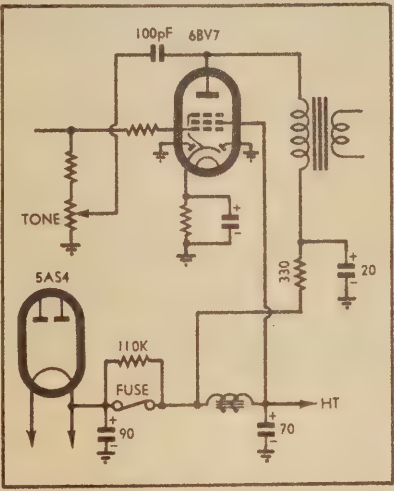
I switched the set on and my first reaction, before I had time to confirm the picture faults, was that the sound was almost non-existent. Since this had not been mentioned originally, I asked the lady of the house whether this had shown up before. She replied that the sound had seemed a little off once or twice, but it had never been as bad as it was now. In the light of subsequent events, it now seems certain that something had changed between the service call and my visit.

Checking the picture confirmed the customer's complaints. In particular it lacked contrast and had shrunk horizontally so that the black border was visible on one side. Also, from remarks made by the owner and his wife I gathered that it had lost horizontal hold and shrunk vertically as well, but the owner had been able to correct these faults with the panel controls.

At this stage I wasn't quite sure whether I had two faults or one. It was possible that the lack of contrast and sound was due to a one fault, and the lack of width, height etc., to another, or they could both have been symptoms of the same fault.

I decided to regard the problem as two separate faults, at least for a start, and proceeded to systematically change the valves in the tuner, IF strip, and video socket. But after the last one had been changed and checked, the performance was just the same, so that squashed that theory.

At this point I decided to cut my losses, pull the chassis, and take it back to the shop. However, I made one concession. I have found it good practice, when a chassis has to be pulled, to take a quick look underneath it before loading it in the truck. It is surprising how often a visual clue will enable one to put the set back on the air in short order. And so it seemed on this occasion. One glance under the chassis was sufficient to pinpoint a badly burnt-up resistor, and I decided to keep on with the job on the spot.



The audio stage of a TV set in which the 330 ohm resistor overheated. How many possible causes of this effect can you nominate?

A closer examination of the chassis and reference to the circuit showed that the resistor was a 330 ohm 1W decoupling unit in the HT supply to the plate of the audio valve, a 6BV7. And, judging by the look of it, it had taken a pretty solid pasting.

Now that I had found the fault, everything seemed clear. There was obviously a serious short, probably getting progressively worse, somewhere in the audio section which, in addition to robbing the audio section of HT, and overloading the resistor, was loading the main HT line sufficiently to produce the various picture faults I had noticed.

All I had to do was find the short.

Looking at the circuit, I immediately picked the 20uF decoupling electro as the most likely culprit. In fact, I felt so sure about this that I simply replaced both the resistor and the capacitor and expected everything to work fine.

It did, too. I switched the set on and the sound came on with a roar. Reducing it to a more moderate level I checked for hum, distortion, etc., and decided that it was working fine. I heaved a mental sigh of relief and took a few minutes off to relax and make sure I had everything handy that might be needed when I came to slip the chassis back into the cabinet.

Having done this, I was just about to check the picture when it happened. Faintly at first, and then with increasing strength, an unmistakeable smell thrust itself upon my nostrils; the smell of a badly overheated resistor. I didn't really need to look, but when I did there was no mistake — the nice new brown resistor I had just fitted was now charred black in the centre.

START AGAIN

Mentally kicking myself for jumping to a hasty conclusion, I set about delving deeper into the circuit in search of the elusive short. With the electro exonerated, the next most likely culprit was the 6BV7, these valves being rather notorious for developing internal shorts. So, I tried a new 6BV7. Alas, the resistor still overheated.

Then I remembered a previous case involving this model set, in which the 100pF feedback capacitor had broken down, putting positive voltage on the 6BV7 grid. The resultant excessive plate current had produced similar symptoms.

I also considered the possibility that the cathode by-pass capacitor had shorted, thereby depriving the value of bias and causing excessive HT drain.

Determined to make a bird of it, I disconnected both capacitors and tried again. Yes, you've guessed it; the resistor still overheated.

At this point I was really puzzled. As

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far as I could see, I had considered virtually every possible cause of excessive current drain through the 330 ohm resistor, eliminated them all, and the resistor still overheated. Clearly, there was something very "funny" going on.

Like a drowning man grasping a straw, I began to wonder whether the replacement 20uF I had fitted was possibly faulty, even though it had no right to be. And, since I didn't have another with which to replace it I decided to try another approach, one which should remove any doubts once and for all. This was to measure the voltage across the resistor and calculate just how much wattage it was dissipating.

The meter read 10V and I made a quick calculation. W equals E squared over R; E equals 10 which squared makes 100. 100 divided by 330 is near enough to 0.3. So the resistor, a 1W type, was dissipating only 0.3W but getting — literally — stinking hot!

Had somebody broken Ohm's law?

And to confuse the issue still further, a test made with the 20uF disconnected resulted in the resistor running perfectly cool.

MOMENT OF TRUTH

It is in this kind of crisis that one either rises to the occasion, or retires to a padded cell muttering something about "theory and practice don't agree." And, since the latter philosophy is one which I have always violently opposed, I just had to find an explanation. Besides, there was the customer to consider.

At this point the lady of the house, possibly inspired by some feminine intuition — bless her — came good with a cup of coffee and light refreshments. It was just what I needed. Quite apart from the refreshment itself, which I suddenly realised I really needed, it gave me time to think a little more rationally than I had been while under pressure — albeit self-imposed.

I wish more customers realised how such a simple gesture can help when things are tough.

As I relaxed and sipped the coffee I marshalled the facts as they appeared. (1) There was no malfunction in the audio stage causing excessive current drain. (2) This fact was supported by the meter reading and calculation which showed only a fraction of a watt dissipation by the resistor. (3) The resistor's behaviour indicated a very much greater dissipation. (4) Whatever the trouble was, it involved the 20uF electro in some way.

Now, since (2) and (3) were in direct contradiction and (3) could not be ignored, there must be something wrong with (2). For some reason my meter reading across the resistor had not told the full story. But why? Even as I posed the question a possible answer presented itself. AC; if there was AC present in the circuit my DC reading would have ignored it.

Almost as soon as the thought presented itself, I knew instinctively it was right, even though the precise source of the AC had yet to be established. I swallowed the remains of the coffee and moved back to the chassis. I switched the set on, leaving the 20uF disconnected from the previous test, set the VTVM to one of the higher AC ranges, and connected it between the "top" of the 330 ohm resistor and chassis. Result: 130V AC where there should have been virtually nil.

And where was it coming from? A glance at the circuit suggested the possible culprit, the 90uF first electro. If this capacitor had failed, the 20uF would try to function in its stead, resulting in a very substantial AC component being superimposed on the DC which the 330 ohm resistor would normally have to carry.

So, in fact, it proved to be, and a new 90uF put everything back to normal — including my confidence in Ohm's law.

Nevertheless, it is a job I shall long remember as being one of the most exhausting and frustrating I have encountered for a long time. Of course, it is easy to be wise after the event and think of all kinds of reasons why the true nature of the fault should have been more obvious, but the fact remains that the major symptoms all pointed in the wrong direction.

As they say, you can't win 'em all.

But the real punch line to the story came a few days later, when I sat down to write these notes. A colleague, who is aware of my nom-de-plume and frequently passes a good story on to me when he encounters it, rang to say that he had encountered a most unusual fault which he thought might interest me.

Imagine my reaction when he identified the make and model of set as the one I had encountered, and then went on to discuss the audio section. By the time he reached the 330 ohm resistor and 20uF electro, I could resist the temptation no longer.

"And the 90uF goes open circuit and the 330 ohm resistor burns up," I interrupted.

I'm afraid his reply was not very polite. Then he muttered:

"I wish you'd told me that yesterday morning, you'd have saved me a couple of hours' work and a lot of frustration."

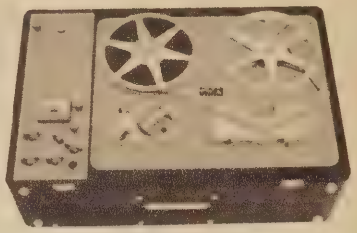
As it turned out, he had been sidetracked in exactly the same way as I had, and his story of false trails, meter readings that didn't make sense, and the final awakening, was an almost exact duplicate of mine.

Perhaps it was selfish, but I found some consolation in the fact that someone else had been caught.

And to finish off, here is another thought about the same circuit. As shown, it contains a feature which, at first glance, appears to be rather pointless. I am referring to the fuse, and the fact that it is shunted by a 110K resistor, apparently doing nothing. Everyone who sees the circuit for the first time, including the draughtsman who prepared the drawing on the previous page, does a double take when they come to this section.

The explanation is simple. When the fuse goes open circuit, the 90uF will be charged to the peak voltage delivered by the rectifier and will remain charged after the set is switched off, since there is nothing to discharge it. This would not only constitute a menace to any unsuspecting serviceman handling the set, but may actually burn out a new fuse which one may attempt to fit. This could occur if the second electro, the 70uF, was completely discharged and was suddenly, in effect, connected across the fully charged 90uF, via the fuse. Admittedly, the choke would tend to suppress the sudden surge of current, but it may not be sufficient to protect a relatively fragile fuse.

VORTEXION



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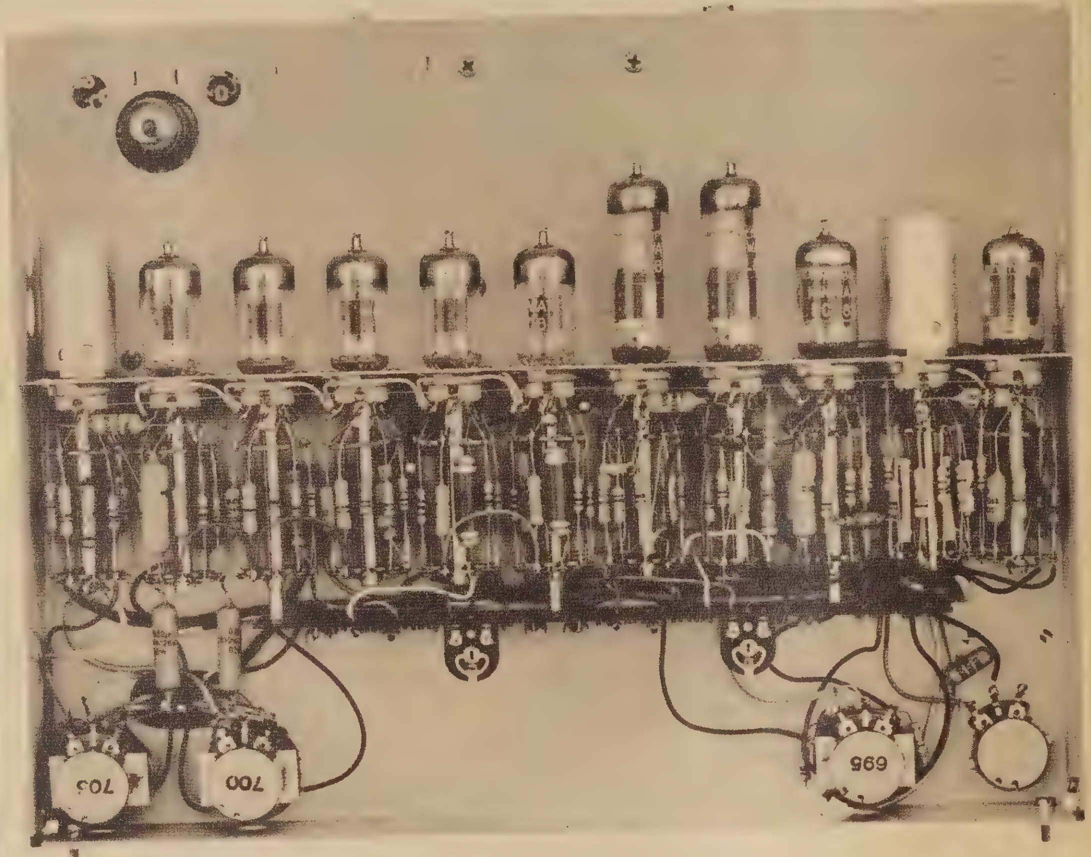

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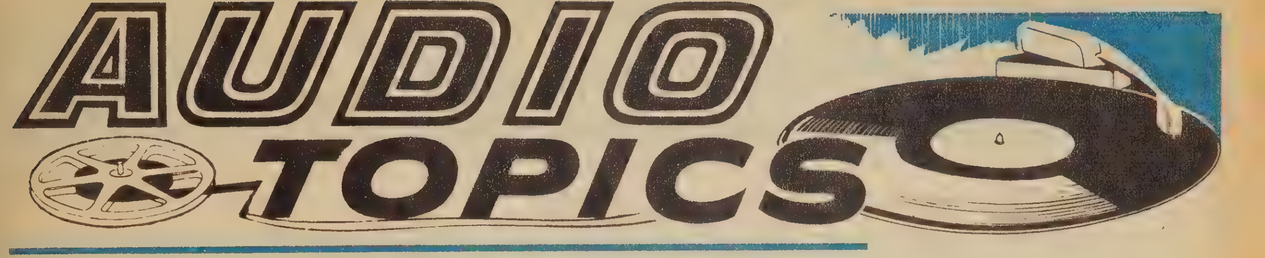

What's ahead for audio tape?

It seems that, on display in Australian electrical and departmental stores, tape recorders are almost as numerous as TV sets, transistor portables and washing machines. Why then hasn't pre-recorded music tape flooded the home entertainment market, making discs a thing of the past? Is it ever going to do so, or is there something else in the future of tape?

By Neville Williams

As we've observed on other occasions, the question of tape versus disc is one attended with a good deal of emotion. One doesn't have to look too far to find extremists, representing opposing points of view, who will admit to no neutral ground.

The fact is, of course, that disc and tape are both with us and are likely to remain with us for a long time to come. They each have advantages and disadvantages which have influenced their relative acceptance to date. They are each likely to benefit from refinements which will influence their relative acceptance in the future.

In the introduction, we posed the question "why hasn't pre-recorded music tape flooded the home entertainment market, making discs a thing of the past?"

There were plenty who prophesied early that it would but the "prophets" are growing gradually older, while the record game remains as virile as ever!

The basic reason why tape has not swept discs off the domestic entertainment market is due largely to the fact that it has not been able to establish a clear overall advantage. In fact, if the disc is at a disadvantage, in some respects, with regard to the tape medium, it also has advantages which more than compensate—at present!

Let's look at a few of the characteristics on which the respective mediums can be compared and judged.

PLAYING TIME: Tape supporters are fond of pointing out that tapes can have longer playing time than discs. This is of some importance for major classical works, but it is not the foundation on which the domestic entertainment industry currently rests. Most of the recorded music which people buy ranges from pop to middlebrow, where individual items and selections are the order of the day.

And in this field, far from record albums being embarrassed for lack of playing time, their capacity is seldom fully exploited. The average popular album presents about five tracks per side, each about three minutes long—adding up, it seems, to as much of a particular type of music as one is likely to want at a sitting.

ACCESSIBILITY: One of the strong points about a disc is the immediate accessibility of any track or part of a track — by the mere act of lowering the pickup in the right place. Equally important, with the jacket in hand, the track which is being played at any time can be readily identified. Tape is seriously lacking in both respects and, while many machines are equipped with counting devices, these are of assistance in identifying tracks only if the owner has calibrated his individual tapes—and sticks to spools having the same hub diameter. For most people, this represents not a challenge but a chore!

HANDLING: Both disc and tape can be damaged by the careless user or by poorly adjusted equipment. However, assuming ordinary care in both cases, discs are easier to handle than tape, at least in its ordinary reel-to-reel form. Strenuous efforts have been made to simplify the handling properties of tape by the introduction of cassettes but none of the cassette schemes yet seems to have "got off the ground."

Intended for educational groups or other smaller-scale professional use, this new PD-10 tape duplicating system introduced by Ampex Corporation can record simultaneously up to three original master tapes of the same source material, from mike or line inputs.

COST: At present, and into the forseeable future, discs have a huge advantage. This stems from the fact that the unit value of blank biscuit is very small indeed and, once the stamping press has been set up, finished discs pop out with a minimum of human intervention and with a quality which can be judged quite well by visual inspection. A spool of blank tape, on the other hand, is a fairly costly medium and the signal has to be copied on to it by an individual recording process. Despite multiple and high-speed copying, the cost is high and this is reflected in the purchase price of pre-recorded tapes.

PERFORMANCE: If one can use this term in a general way to refer to the average listener, the sound quality of both mediums is more than adequate for present requirements. The average record player or tape player falls well short of the potential of the basic recording. There is therefore no real compulsion to drop one and adopt the other.

HI-FI PERFORMANCE: A more critical comparison of good commercial pre-recorded tapes with good discs is likely to show the tape as being slightly more brilliant and cleaner in the trebles and having better stereo separation. Unfortunately, it is also likely to reveal that the tape has a higher noise level for a given system-bandwidth and this may well be reckoned as a high price to pay for the other qualities. It would appear that the noise (mainly "hiss") level arises from the fact that tape tends to have a certain noise content and that the one you buy is most likely to be a fourth-generation product at least, made up as follows: (1) The original multi-track recording. (2) The two-track mix from the above, which becomes the new stereo master. (3) Copies from the stereo master which can be made available as production masters, and (4) The copy you buy.

Added to this is the fact that narrowing of the track in the interests of

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tape economy diminishes the final signal-to-noise ratio, from tape to speaker by between 3 and 6dB each time the track width is halved. Four-track stereo tape, with its narrow tracks and its two sources of noise in the room, has seemingly overstepped the limits for hi-fi reproduction, as techniques stand right at this moment.

Unofficially, recording company representatives have admitted this and the companies are making determined efforts to better the signal-noise ratio in their mastering processes and to use better quality tapes for the final over-the-counter product.

WEAR PROBLEMS: Supporters of the tape system have been quick to point out stylus wear problems in disc systems, the damage that occurs when discs are played with faulty styli and the noise which can result from surface contamination. However, it is becoming apparent that, while tape systems don't suffer from these exact faults, they have their own near-equivalents. (1) Tape heads wear and the replacement of heads at several pounds apiece, plus service charge, is a more serious business than a new diamond at a couple of pounds—and do-it-yourself. (2) Tape heads become magnetised with a consequent rise in noise level, requiring steps to de-magnetise them, which may or may not be simple or successful. (3) Magnetised heads can increase the noise level on pre-recorded tapes, such damage being permanent.

If the assessment were to finish at this point, the reader might be excused for concluding that tape had very little to commend it as a medium for domestic entertainment and that the disc would always dominate this field. Certain it is that these facors have ensured the ascendency of the disc to date but this is not the end of the story.

While the demand for pre-recorded tapes is relatively modest, the demand has nevertheless made it necessary, for example, for Ampex International to expand and re-plan their activities in this field. In a recent publicity release they stressed the rising demand for pre-recorded tapes, and announced a catalogue of 1,300 titles from 25 labels and plans to market more and cheaper tapes in a variety of reel and speed formats. Mention was made of new master recorders capable of performance figures not attainable "as late as a year ago."

It is undeniable that tape has a tremendous utility and gimmick value that has ensured its acceptance in homes, alongside the domestic record player. Because the owner can make his own recordings easily and (with some qualifications) successfully, tape recorders have won themselves a position as some kind of a status symbol. "No home should be without one." Junior can use it as an elaborate toy; his student brother and sister can use it for music and speech training and as a study aid; it's handy for both of them to record the latest pop tune off-air; dad finds a use for it in his business activity; it may find restricted use as a second source for serious music, and so on.

For all the above reasons, the tape recorder continues to be a useful and intriguing device and manufacturers' efforts to date have been towards making it more so and, at the same time, cheaper.

Their efforts have led to interesting divergences from the mainstream of "ordinary" reel-to-reel recorders. One such divergence adds all the technical trimmings, knobs, switches, meters, stereo, track-on-track facilities, multiple inputs, multiple outputs—the works.

At the other extreme are recorders from which every optional control has been stripped, leaving the fewest possible for the operator to manipulate. Some such machines feature automatic threading, automatic reverse and automatic switch-off at the end of a predetermined playing cycle.

The most recent addition to the Stirling Moss "Stable" of fast touring cars is fitted with a stereo tape cassette system.

But knobs or no-knobs, automatic or manual, all these machines are essentially variations on the theme of the traditional tape recorder and, as such, are not likely, of themselves, to initiate any revolution in tape usage.

There are, however, two situations which could produce such a revolution. Both have to do with the fact that many people like a musical background to certain activities—manual work, hobbies, light reading, dining, driving in the family car, etc. As mentioned elsewhere in this issue, such music needs to have a basic appeal to the people involved but it should be of such a nature that it does not demand the attention that they are trying to give to the main activity.

People have long tried to meet the need by tuning to radio stations but with a degree of success which seems to have diminished with the passing years. Certain it is that the current radio program pattern of news flashes, teenage pops and high-pressure advertisements is diametrically opposed to the basic requirement of a non-intrusive sound.

In industrial and commercial centres, there has been a swing to using wired sound from professional suppliers of same, or to a similar style of music superimposed on the carrier of certain FM stations.

For private use, it is interesting to speculate whether there is a future in "marketing" this kind of music service. In the meantime, however, modern technology makes it quite practicable for homes—and commercial enterprises for that matter—to have their own private background music for as many hours of the day as might be deemed desirable.

It can be done, at present, with an automatic record changer and a stack of long-playing discs, selected for the purpose. However, discs in their present form are not ideal, as much as anything because the playing time of a stack of popular LP albums is not all that long, when compared with the number of hours in a working or waking day.

Here tape has an apparent advantage. A large reel of mutiple-play tape, operating at the slow speeds which are now practibable, could play for many hours; as a matter of fact, with automatic to-and-fro reversing, it could play indefinitely. If fitted in a cassette, no rewinding would be necessary; it could be plugged in and start playing from any point along its length. It might well be established that, for such a purpose, the requirements for dynamic and frequency range and even stereo would be far less demanding than for recorded music intended to be featured.

Equally, it might be argued that discs could be provided with far longer playing times than at present, with the further advantage that the playing equipmen could be alternatively useable for more conventional albums of feature music.

This might be so, although I imagine that it would still be difficult to topple the advantage of tape in this kind of application.

To mention Ampex once again, this company has announced its intention of marketing background music tapes for playback at 1-78 i.p.s. and containing up to six hours of music on a reel.

But the really interesting possibility that lies ahead of tape is in providing background and entertainment in road vehicles.

A large number of cars on the road are fitted, these days, with radio receivers but there is common complaint about the kind of programs which are available.

Disc systems have been engineered for vehicular use but a car is not an ideal place to store, handle and play discs, particularly for the driver travelling alone. Neither, for that matter, is it any place for a conventional reel-to-reel tape system.

But it is an excellent place for a long-playing and possibly self-reversing tape cassette. In fact, if some of the big American companies like Ford, RCA and Lear-Jet have their way, the current year will see a crop of car radios with a slot just above the conventional tuning dial. Push a special cassette into the slot and the car radio turns into a stereo tape player, with 80 minutes of music per cassette, and feeding either two of four speakers strategically placed within the car.

And this may well be the ace which tape has up its sleeve. It looks like being unbeatable in the family car and it will provide the incentive for the car owner to build a stock of cassettes to keep the "taperadio" fed.

But once having built up a stock of cassettes, he may well want something in the house to enable them to be played there also—thereby creating a demand for a domestic tape cassette player of the type that, up to date, he hasn't wanted! ◘

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Classical reviews

By RAMSAY PENNICUICK

"Australian Music Today"

AUSTRALIAN MUSIC TODAY. A joint project of the ABC, the Australian UNESCO Music Committee and the World Record Club. 5A601-2. These two volumes present Los Alborados by Richard Meale; String Quarter No. 6 by Peter Sculthorpe; Five Australian Lyrics by John Antill; From Within Looking Out by George Dreyfus; Laudes by Nigel Butterly; Four Divine Poems by Julienne Le Gallienne; String Quartet No. 6 by Felix Werder.

These two volumes of recordings give a splendid picture of the work that is being produced by Australian composers, and demonstrate the fact that their works are comparable with those produced by leading composers in other parts of the world. From the seven works presented, I have chosen to review two works I had not previously heard.

The first of these is the String Quartet No. 6 by Peter Sculthorpe who was born in Launceston, Tasmania in 1929. He studied at the Melbourne University Conservatorium and then proceeded to Oxford on the first award of the Lizette Bentwich Scholarship. At Oxford he studied with Edmund Rubbra and Egon Wellescz. While in England Sculthorpe won a reputation as a composer and a lecturer and in 1955 he won a scholarship at Warmstadt, Germany to study serial technique. Returning to Australia, he won increasing fame with his works, several of which were commissions. He is now a lecturer at the University of Sydney but leaves at the end of this year to take up a Harkness scholarship at Yale University, U.S.A.

He admits that the paintings of Russell Drysdale, and D. H. Lawrence's novel, "Kangaroo," have influenced him but with regard to his style of writing he says "At one stage, before I went to Oxford in 1958 I was experimenting on my own with serial composition. I was serialising notes, then rhythm, volume, timbre and everything else but came to the conclusion that if I drove this to its logical conclusion the result would be silence."

Scuthorpe's Quartet No. 6 is in three movements and in some curious way it suggests an Australian idiom. I think this is primarily due to the fact that each movement gives a feeling of loneliness and often of grief, two qualities which are generally accepted as being predominant in the Australian landscape. Sculthorpe was commissioned to write the work for the Alfred Hill Memorial Award. The work is not difficult to follow, the only musical influence I can observe being that of Bartok; it is short but well proportioned, the general atmosphere being one of sorrow but there are certain lyrical passages of great beauty. Its moving quality is enhanced by the excellent playing of the Austral String Quartet consisting of Donald Hazelwood and Ronald Ryder, violins, Ronald Cragg, viola and Gregory Elmacloglou, 'cello.

The second work I have selected is "From Within Looking Out" by George Dreyfus. The composer was born in Germany in 1925 and came to Australia in 1939. He studied at the Melbourne University Conservatorium where he is now teacher of the bassoon. He returned to Europe and studied in Vienna in 1955/56. Returning to Australia he played the bassoon in various A.B.C. orchestras but in 1964 he resigned in order to devote himself entirely to teaching and composition.

The present work is written for soprano, flute, viola, celeste and vibraphone and the text is a Street Song from Ammam. The work is in five movements and is written in serial technique but the composer cleverly avoids the manufactured effect that so much of this type of composition suggests. The enchanting ethereal sounds of the instruments often suggest a Balinese gamelan against which the arabesques of the voice add piquancy.

The performers are Marilyn Richardson, soprano, Margaret Crawford, flute, John Glickman, viola, Kay Lucas, celeste and Glen Davis, vibraphone, who are all most skilful. The performance is conducted by the composer.

The two volumes are excellently presented with copious notes and texts and an original cover design by Olsen. The recording is very good and the issue is of great interest to all music lovers who follow the developments of music in Australia.

★ ★ ★

BEETHOVEN. Sonata in F. minor, op. 57 (Appassionata). Sonata in C, op. 2 No. 3. Artur Rubinstein, pianist. R.C.A. Mono LM2812. Stereo LSC-2812.

The Sonata in C, op. 2 No. 3 has always been one of my favourites of the Beethoven Sonatas. The writing is much more pianistic than it is in the later sonatas, some of which probably plumb greater emotional depths but are often awkward to play—to say the least.

In 1792, the 22-year-old Beethoven arrived in Vienna to study with Haydn but the latter had become rather spoiled by his great success in England and was not very interested in teaching. The result was that Beethoven took lessons on the side from the equally highly qualified but less famous composers Schenk and Albrechtberger. However it was important that Beethoven should make his debut as a Haydn pupil so he dedicated his three sonatas op. 2 to Haydn and in many ways paid that famous composer the compliment of imitating his work.

We were lucky enough to hear Rubinstein in Sydney last year and although aged 75 his powers were not in the least diminished. The present sonata is superbly played. There is not the slightest blurring of any passage. The long Adagio can very easily drag but the pianist keeps it moving and sustains the interest throughout. The Scherzo is wonderfully rhythmic and the last movement, taken at a very fast speed is full of zest and vitality. Altogether it is the best performance of the work that I have heard.

By 1806, the obscure musician from Bonn had become a Viennese celebrity but his increasing deafness made communicating with his fellow men very difficult. In addition he was in love with two girls. Consequently one can imagine his state of mind when he planned the sonata known as the Appassionata. (The subtitle was not the composer's.) He could now ignore the Haydn traditions of form and wrote the present sonata in three movements, the strong opening movement being followed by a theme and four variations which lead without a break into a Finale of which the form is very irregular. The playing is just as fine as in the earlier work; everything is clear and controlled with great contrasts of tone. The piano is splendidly recorded in every detail.

★ ★ ★

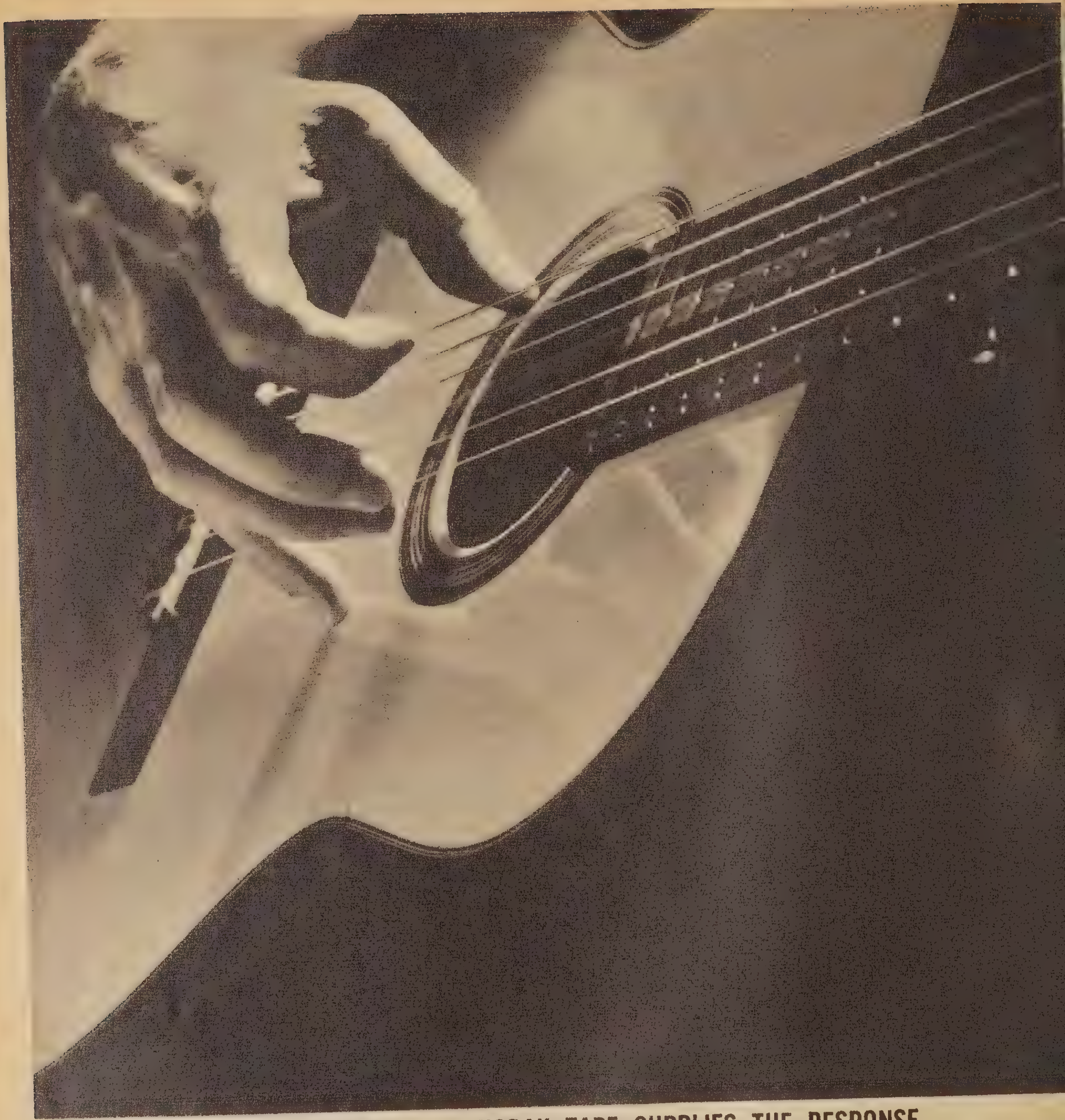
HOROWITZ. Carnegie Hall Recital, May 9, 1965. A recording of his first concert in 12 years. Bach/Busoni, Organ Toccata in C major. Schumann, Fantasy in C major, op. 17. Scriabin, Sonata No. 9 in F major, op. 62, and Poem in F major, op. 32 No. 1. Chopin, Mazurka in C sharp minor, op. 30 No. 4, Etude in F major, op. 10 No. 2, Ballade in G minor, op. 23. CBS Stereo SBR 220012, Mono BR 220012.

After an absence of 12 years, the return of Vladimir Horowitz to the concert platform was bound to be an extraordinary occasion. In various Press interviews the pianist stated that for thirty-one years he had rushed like a madman catching trains on which he could not sleep, or read, also he didn't like flying. However, after many years he decided that he was tired of recording and wanted to play to a living audience again. His return to the public platform is recorded on this disc. I might say at once that the record is extraordinarily good, although I found the incessant applause between the pieces rather distracting.

I do not consider the Bach Toccata performance equal to that of Rubinstein. In the first place the latter pianist uses an arrangement that I think is more effective than that of Busoni and I do not think Horowitz has the breadth and poetry of Rubinstein in the adagio. Technically, of course, the playing is wonderful.

The Schumann Fantasy is a wandering work and I feel the pianist allows it to wander too much. It really loses all shape.

I am delighted that Horowitz has included Scriabin on his program, as I have always considered him a most neglected composer. The Sonata is a fascinating work and so are the Poem in F sharp major and the Etude in C sharp major which is amongst the encores. Horowitz seems to sense the



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curious romantic mysticism with which the composer's work is imbued and the performances are excellent. The Chopin works are most splendidly played in every respect. I have never heard the last section of the G minor Ballade taken at such a speed and yet every note is in place. The encores include an enchanting performance of Debussy's Serenade For The Doll. The piano tone is splendidly recorded throughout the recital.

* * *

TELEMAN IN PARIS. Motets "Deus Judicium Tuum Regi Da" and "Wie Ist Dein Name So Gruss." Edithe Selej, soprano. Jeannine Collard, contralto. Peter Witsch, tenor. Barry McDaniel and Jakob Stampfli, basses. Philippe Gaillard Choir and Chamber Orchestra of the Saar Radio Orchestra. Conductor: Karl Ristenpart. Record Society Edition No. 6164. Mono and Stereo.

Georg Philip Teleman is a composer who seems to have gained the recognition due to him only since the advent of long-playing records, yet in his own time he was considered superior to J. S. Bach. When the latter applied for the post of Cantor at St. Thomas', Leipzig, he obtained the post only because Teleman had refused it.

Teleman's fame had spread throughout Europe and he had frequently been invited to Paris; finally in 1737 he decided to undertake the journey. He was most warmly received and the last event of his stay in Paris was the commission for the motet Deus Judicium Tuum Regi Da. It is based on the Latin text of Psalm LXXI. It is divided into five sections, the first movement being in the style of a French Overture. The second section consists of solos for soprano, bass and tenor, which are all well sung apart from the fact that the attempts of the tenor and bass to sing trills are not very successful. Then follows a chorus, further solos for bass and soprano and a duet for soprano and contralto, then the work ends with an impressive fugue for chorus.

The other motet, Wie Ist Dein Name So Gruss, based on Psalms VIII and XXIX, is even more effective, mainly because the various solos are often accompanied by solo instruments. Particularly lovely is the contralto solo with an obligato played by the oboe d'amore. The originality and power of Teleman's work cannot be denied and the works fully justify the composer's popularity in this form. The recording is very good throughout.

* * *

BERLIOZ. Romeo and Juliet, op. 17. Gladys Swarthout, mezzo, John Garris, tenor, Nicolo Moscova, bass, Chorus directed by Peter Wilhousky. N.B.C. Symphony Orchestra conducted by Arturo Toscanini. R.C.A. Mono. LM 7034.

This is a recording never before released, made from two N.B.C. broadcasts of February 9 and 16, 1947. The composer called the work a dramatic symphony and the elaborate brochure accompanying the two records not only emphasises the fact that the composer considered it the best of his works but points out at some length the great admiration that Wagner had for it.

The work depicts Shakespeare's play in a series of scenes but the soloists do not portray any of the characters in particular but, together with the chorus, are simply used to tell the story.

I have never been a great admirer of Berlioz and although I realise how his experiments in orchestration helped the composers who followed him I have always felt his themes cheap and unremarkable. Wagner presented the composer with a copy of the first edition of his Tristan as a sign of his appreciation of Romeo but surely the former work excels the latter in every respect.

It appears that Toscanini was always very keen about the work and welcomed the chance to broadcast the entire symphony in 1947. Certain parts of it such as the Love Scene and the Queen Mab Scherzo have always been in the orchestral repertoire.

The performance is masterly in every respect and has been dubbed with great skill. Toscanini never misses a point and drives the work along with all his famous energy. The soloists and chorus are all splendid. The work is sung in French and a feature is the remarkably clear diction of all concerned, but it may not altogether be praise for a foreigner to understand the words when none of the singers themselves are French.

The orchestral playing is superb and the work will be of great interest to all followers of Toscanini and all admirers of Berlioz. The record surface is excellent.

* * *

J. S. BACH. St. Mark Passion. Helen Erwin, soprano. Emmy Lisken, alto. Georg Jeldem, tenor. 2 violins, 2 flutes, 2 oboes, 2 violas da gamba, lute, cello and organ. South German Madrigal Choir of Stuttgart and the Pforzheim Chamber Orchestra. Conductor: Wolfgang Gonnenwein. World Record Club. Stereo. 5/MF2128.

For over 25 years, German musicologists have been examining the problem of Bach's St. Mark Passion. It was known that the work was first performed on Good Friday, 1731. It must be remembered that in the Baroque period many works were written to celebrate some particular event and not performed again. Bach, like Handel, realised the wastefulness of such a procedure, so did not hesitate to adapt a composition to a new text. This he always did with consumate skill. When he conceived the idea of a St. Mark Passion he at once though of a Funeral Ode which he had written in 1727 upon the death of Princess-Elector Christine Eberhardine. This work seems to have been the base of the St. Mark Passion, with additional numbers for which his favourite writer, Picander, supplied the texts.

On Bach's death the work was lost. However, thanks to the research of the German scholars the reconstructed work was performed in Mainz in 1964 and it is this reconstruction which is now recorded. There are two solos for soprano, two for alto and one for tenor and one of the most pleasing features of the work are the accompaniments for the solos. The unusual instruments create fascinating effects of soft colour. The chorales are splendid, the soloists all adequate and the work itself, while not on the scale of the Matthew Passion, is of great interest. Gonnenwein seems a skilful conductor and the recording is good.

RIGOLETTO. Highlights in English. Elizabeth Harwood, Donald Smith, Peter Glossop, Donald McIntyre, John Chorley, Charles Draper, Maureen Grey. Sadler's Wells orchestra conducted by James Lockhard. H.M.V. Stereo SOELP 9140. Mono OELP 9140.

This is a record which is presumably put out to puzzle the music lover. The sleeve has no notes whatever and one is not even told who sings which part. I presume Miss Harwood sings Gilda, Donald Smith the Duke, Peter Glossop Rigoletto and Maureen Grey Maddelena. Beyond this I dare not guess. Even with the aid of several scores it is difficult to follow the work, as English translations are all different.

Miss Harwood sang in Sydney with the recent Sutherland opera season and proved to be a very ordinary coloratura soprano who stepped very warily in any high passage. She is only reasonably satisfatory as Gilda. Donald Smith is the Queensland tenor who went to England some years ago and who has certainly improved very much both in regard to voice and style. Peter Glossop is the only one of the cast who impresses one as an outstanding singer. His performance of Rigoletto is excellently sung and he gives a moving interpretation of the tragic role. Miss Grey is satisfactory in the famous Quartet. I presume there is a demand for records such as this but surely they could have cover notes to help the listener. The playing of the orchestra and the recording are good.

* * *

MOZART. Concerto for oboe and orchestra, K314. Concerto for horn and orchestra, K417. Concerto for flute, harp and orchestra, K299. Gaston Crinelle, flute. Pierre Gamel, harp. Marius Briancon, oboe. Louis Bernard, horn. Salzburg Mozarteum Orchestra, conducted by Bernard Paumgartner. World Record Club. Stereo TE/378. Mozart. Concerto for flute, harp and orchestra, K299. Adagio for glass harmonica, K356. Fantasia for mechanical organ, K608. H. Stork, harp. G. Pateno, flute. H. Rilling, organ. B. Hoffman, glass harmonica. Wuertemberg Chamber Orchestra, conducted by G. Faerber. Universal Record Club. UC693.

The important work which these two records have in common is the Concerto for flute and harp. This work was written in 1788 for the Duc de Guise and his daughter both of whom Mozart described as playing extremely well. It is a charming work in typical French salon style, particularly the tempo di gavotta which forms the third movement. The amazing thing is that the composer could write such delightful composition for these instruments since he stated in his letters that they were two instruments he disliked.

The performances on these two records are both most capable but I think the Universal Record version is the more vivid of the two and the recording is clearer.

The oboe concerto is one of his earlier flute concerti transposed into the key of D major. It sounds excellent on the oboe and is most gracefully played by Marius Briancon and excellently accompanied. The last movement has a theme which the composer has used on other occasions. I do not find the horn concerto so interesting but it is again well played. The Adagio for glass harmonica was written for a young blind virtuoso of the instrument, which was invented by Benjamin Franklin. I do not think one should take the work seriously.

The Fantasia for mechanical organ was a commission from a Count Deym who owned a gallery with various wax figures and automatons including mechanical organs. The composer was unable to become enthusiastic about the "really too childish" sounds so wrote with the idea of the work being performed on such an organ as that in St. Stephen's Cathedral, Vienna.

The works were all occasional pieces for Mozart and he took into consideration the limitations of both his performers and their instruments when writing them. The manner in which he rose to the task is surely remarkable.

* * *

MAGGIE TEYTE. French Songs Vol 1. Berlioz, Chausson, Ravel, Duparc. H.M.V. Great Recording of the Century Series. COLH138.

Great Recordings of the Century are certainly responsible for the re-issue of some of the greatest performances of the past.

Dame Maggie Teyte is one of the most famous interpreters of French music. The present record is of great interest, as all the songs have orchestral accompaniments and were mostly issued about 25 years ago. The work of Chausson, though recorded in 1946, has not previously been issued.

The first two songs, Le Spectre de la Rose and Absence, are from Berlioz's song cycle Les Nuits D'ete. I have never cared much for the work and although Dame Maggie sings the two songs perfectly I think they are the least interesting part of the record.

The next work is the Poeme De L'amour Et De La Mer by Chausson, a composer who was killed in an accident at a comparatively early age but who left a Symphony and a Poeme for violin and orchestra which show him to have been greatly gifted. The present work is best known for the last section of the second half which is often performed as a vocal work under the title Le Temps Des Lilas and was a favourite of Dame Nellie Melba. The orchestral scoring is very lovely and the voice part completely suits the singer who conveys all the pathos of the moving words. The orchestra is conducted by Leighton Lucas.

This is followed by one of Ravel's masterpieces, Sheherazade, whic consists of three songs, Asia, The Er chanted Flute and The Indifferent On In Asia, the singer's voice changes i quality with the thought of all the di ferent countries she would like to vis and rises to a splendid climax on th high B flat. The rocking of the ship wonderfully depicted and the chinoiseri of the visit to China is a masterl example of the composer's skill.

The Enchanted Flute reminds me c Daphnis and Chloe and The Indiffe ent One is extremely subtle and wo derfully interpreted by Dame Maggi The Royal Opera House Orchestra conducted by Hugh Reynold.

The record ends with three of Du parc's finest songs. This enigmatic composer's reputation rests entirely on hi thirteen songs, most of which are mas terpieces. The three recorded are ver well known but gain immensely fro the orchestral accompaniments, the las one, Chanson Triste, using a harp ir stead of the usual piano. Dame Maggi has always sung these songs superbl not only from a vocal point of vie but with her perfect pronunciation o the texts. The orchestra for the Dupar songs is conducted by Leslie Heward. have not heard a record for a lon time that has given me such pleasure The dubbing is wonderfully done.

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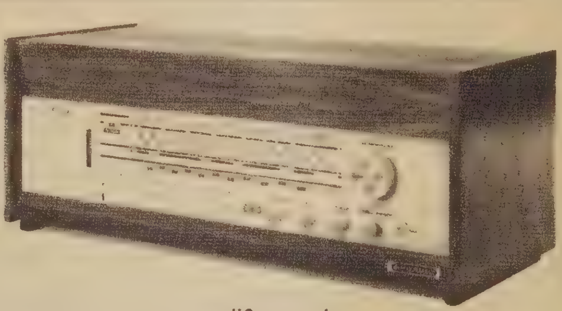

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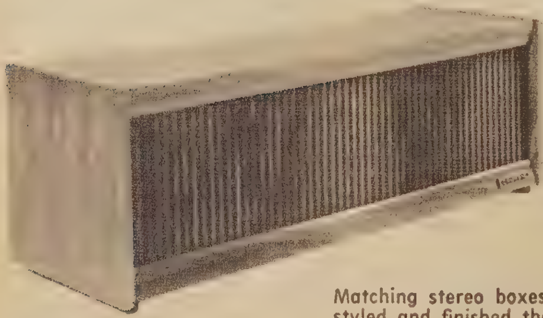

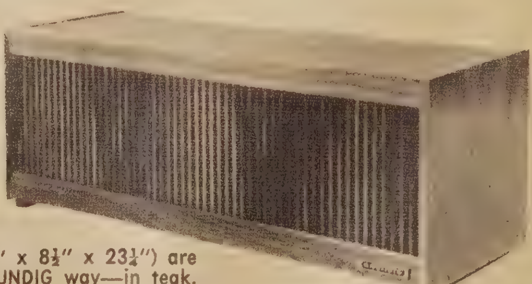

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DOCUMENTARY RECORDS

Reviewed by Ellis Blain

HENRY LAWSON'S AUSTRALIA, spoken by Leonard Teale CBS BP 233225.

And still the records of poetry come in. Already, it is by far the most prolific subject for documentary on commercial records. And no wonder, for doesn't poetry come to life when it is spoken? Clearly, we have at last outgrown the idea that it is effeminate stuff. In fact, the same idea persisted not so long ago about serious music but, thanks largely to the advent of long playing records, both have now come into their own as important, even indispensable aspects of what might be termed the contemporary repertoire of home entertainment.

This third volume of Henry Lawson represents the essence of Australia at the turn of the century — perhaps the most individual Australia there will ever be. In his notes, Leonard Teale writes: 'I don't think there's anyone who presented a more accurate picture of Australia during the important years just before and after Federation than Henry Lawson. In his work you find all the courage, the tragedy, the hopes, the despair that led to the formation of a nation from six isolated States."

I must say I prefer the method of direct selection from the author's work employed here to the slightly gimmicky approach to the previous album. Once again, I can commend Leonard Teale's reading without reservation. The recorded sound and album presentation are first class. In fact, if you are interested in Lawson and haven't invested in the either of the earlier issues, his one may represent the best value of he three.

* * *

AN HISTORICAL ANTHOLOGY OF AMERICAN POETRY. Edited and read by Robert Beloof. Argo RG 245 and RG 246.

A two-record set from Argo that departs radically from their usual approach to poetry presentation. This is one of the most difficult collections to appraise that has come my way. One's reaction to it is bound to be personal, since it is a personal selection, edited and read by an individual, rather than an anthology chosen according to a representative plan and presented by professional readers. But don't let me give he impression that Mr Beloof is not a professional reader. The fact is he is much more than just that; he is Professor in the Department of Speech at he University of California. He was also Fulbright Professor of American Literature in Italy and, as such, the lecturer most in demand in that country for many years.

But I must state my reservations about hese records. First of all, I am by no means happy with the selections. For example, the choices from Whitman are uncharacteristically dull. Admittedly, hey may be excellent examples of his iterary style and ideal as illustrations for a lecture but where are the rolling, extravagant, boastful phrases, the rich and resonant imagery of "Leaves Of Grass"?

Again, I find it difficult to adjust myself to the sound of a broad American accent in poetry — even American poetry — and, while admitting that such a prejudice is insupportable, I mention it so that a prospective purchaser may examine his own attitude in advance. But it is a particularly unemotional delivery and a rather thin voice quality and this may well be the basic cause of my quarrel on this score.

Finally, I do not care for the incorporation of references such as "Song Of Myself, Section Five" in the spoken text. For me, interruptions destroy the mood and smack too much of the classroom.

But all these disagreements are in the main swept aside by the fact that these are, in most cases, the only versions of the works available on record and without doubt, the selection has been compiled with great care, knowledge and attention to deail. The pieces by Emily Dickinson in particular are cameos of rare worth. Recording and presentation are up to the best Argo standard.

* * *

ROBERT DONAT READS SELECTED POETRY. ARGO RG 437.

A second volume that follows closely the pattern of the previous issue, except that the selections here are more popular, including such well known classics of English literature as Keat's "Ode To A Nightingale" and William Wordsworth's "Immortality," together with twentieth-century favourites by Rupert Brooke, Wilfred Owen and John Betjeman.

The record's appeal will be dictated solely by your attitude to Donat who was one of the most loved and admired actors of recent times. He died prematurely after a tragic struggle with chronic asthma and, in the years before his death, spent much of his time with an ordinary domestic tape machine, recording and re-recording readings of poems in which he had a special interest. As a result, the performances are often deeply moving for the individuality and penetration but the quality of sound, inevitably, is far below average.

Both these records have a special place in my own collection but for purely personal reasons. ■

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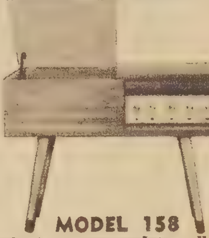

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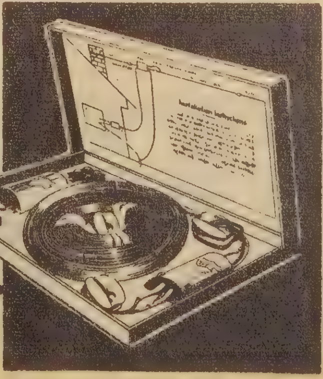

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It is interesting to compare both the advantages and limitations of other types of cartridges:

The popular moving magnet design is an excellent compromise and was used by Audio Dynamics in its first series of cartridges (the ADC 1, 2 and 3). However, it presents two problems, which are difficult to overcome: The moving magnet itself is relatively heavy (irrespective of its shape), thus increasing the mass at the stylus tip. Also, in order to obtain reasonable efficiency, both poles of the magnet must be placed between the pole faces of the cartridge's magnetic structure thus necessitating a fairly long cantilever in order to give sufficient stylus clearance and to maintain the correct tracking angle. This long cantilever is very difficult to make with adequate stiffness, to prevent resonance or decoupling without excessive mass.

Another group of cartridges, with which comparison may be made, are those where the motion of the stylus is transmitted to some sort of fairly rigid generating element, such as a Piezo electric ceramic or a semi-conductor strain gauge via a coupling yoke. Both of these systems have the advantage of considerably higher output, when compared with a magnetic cartridge. This is of real value, where use is contemplated with an amplifier of poor quality, when hum and noise are present. With today's high-quality equipment, this is of no practical advantage, however.

Of the two types, the semi-conductor strain gauge version is the more attractive in that it is capable of very high outputs and presents an excellent impedance match to many amplifiers. Its only disadvantage, in comparison with the more common ceramic type, is the need for a separate power supply.

Both these cartridge types have the disadvantage of being mechanically rather complex. They usually incorporate a cantilever, which serves to carry the stylus and transmits its motion to a semi-flexible coupler, which in turn transmits the motion to the generating elements. The coupler serves both as a mechanical impedance matching transformer and as a means of decoupling motion from the unwanted channel, to provide stereo separation.

Even the best of these designs suffers to some extent from resonances of these components, which in the best cartridges are critically damped. This necessary damping in turn produces stiffness in the stylus suspension, while the multitude of parts tends to have its mass reflected in the total mass seen at the stylus tip.

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VARIETY FARE

"ELECTRONICS Australia"
Staff Review
Panel

Devotional

SONGS THAT LAST FOR AYE. The Scottish Festivals of Male Voice Praise, conducted by James McRoberts. Mono, EMI Parlophone PMCO-1244. (Also available in Stereo PCS0-3064.)

Interest: Male voice choir.
Performane: High standard.
Quality: Good.

One becomes so accustomed to vocal records with heavy instrumental support that, to me, the first few bars of this one sounded rather bare. The impression soon disappeared, however, with the realisation that this choral group specialises in unaccompanied singing and is so well disciplined in its harmony that instrumental accompaniment is superfluous.

This does not mean that the sound is "glossy," a term that might be applied to certain smaller, professional chorales. Here and there individual notes and voices stand out exactly as they do in any such choir and I'm not so sure that the disc doesn't gain authenticity from these "human" touches.

One thing is certain — these men love their singing, their hymns and the musical tradition behind them: "All Hail The Power," "Jesus, The Sinner's Friend," "Blessed Assurance," "There Were Ninety And Nine," "I Am So Glad That Our Father In Heaven," "Is There Anybody Here Who Loves My Jesus," "God Is Here And That To Bless Us," "Guide Me, Oh Thou Great Jehovah," "We Plough The Fields And Scatter," "Till He Come, Oh Let The Words."

Each of these hymns receives separate mention in the notes, with relevant pointers to the words and music. Knowing the following that the Scottish Festivals of Male Voice Praise have, there should be plenty of buyers for this one. (W.N.W.)

* * *

BLEST BE THE TIE THAT BINDS. Pat Boone and the Lipscomb A Capella Singers. Stereo, Dot (Festival). SZL-931,611. (Also available in mono ZL-31,611.)

Interest: Traditional hymns.
Performance: Good unaccompanied singing.
Quality: Good.
Stereo: Normal spread.

Here is another album of unaccompanied singing but quite different in character from the Scottish Festivals reviewed above. That record has all the weight of massed male voices and a good deal of characteristic spontaneity. The Lipscomb Singers is a much smaller College chorus whose role is to provide restrained backing for the college "old boy," singing star, Pat Boone.

Apart from one or two hymns in which the tempo has been deliberately accelerated, the whole mood of the record is quiet and thoughtful, in the Pat Boone manner. It should please those with conservative tastes in devotional music but certainly won't please others who like their hymns with a touch of rhythm or fire.

The hymns: "Peace, Perfect Peace," "Eternal Father, Strong to Save," "Amazing Grace," "Come, Thou Almighty King," "O Worship The King," "Blest Be The Tie That Binds," "Jesus Lover Of My Soul," "Holy, Holy, Holy," "All Hail The Power Of Jesus' Name," "Dear Lord And Father Of Mankind," "When Peace Like A River," "Softly Now The Light Of Day."

This is one you'd better hear for yourself. (W.N.W.)

HOW WE LOVE TO SING. The Nelson Brothers Quartet. Stereo, Supreme "Console" (Southwell Supplies) S-202. (Mono M-102.)

Interest: Gospel songs.
Performance: Excellent.
Quality: Good.
Stereo: Normal.

According to the jacket notes, the Rev. and Mrs Albert Nelson had 12 children, most of them musically inclined and able to constitute, between them, a family orchestra and vocal group. Though members of the family have since married and separated, five of the brothers have managed to maintain (in varying combinations) a quartet which turns its talents exclusively to Gospel music.

In this album, supported by piano, organ, bass and guitar, they provide varied selections of Gospel songs in a manner as capable and smooth as one would expect from a mature male quartet.

"How We Love To Sing," "On The Jericho Road," "A Crown Of Thorns," "Jesus Saviour," "All Night, All Day," "Come, Ye Disconsolate," "Every Moment Of Every Day," "I Took My Troubles To Calvary," "We Shall Shine As The Stars," "The Wondrous Name Of Jesus," "When We See Christ," "After," "Farther Along."

An imported pressing, the quality is very good, with a low surface noise. In short, a Gospel record that should find wide acceptance. (W.N.W.).

Instrumental, Vocal & Humour

HUMORESQUE AND OTHER FAVOURITES For Violin and Orchestra. Yoshio Unno and the Leon Pops Orchestra. Festival (King Records). SFL-931,763.

Interest: Virtuoso violin.
Performance: Facile—very.
Quality: Excellent.
Stereo: Normal.

The jacket notes have all the usual things to say about the Japanese King Record Company's "Super Dynamic Sound" but nothing at all about the featured artist or the Leon Pops Orchestra, itself.

Listening to violinist Yoshio Unno, however, I was reminded strongly of Florian Zabach, with his lush, heavily accented melody line, designed to catch the ear of a relaxed audience—at the dining table or at home in an easy chair.

And the tracks fit in with the mood: "Tambourin Chinois," "Rondino On A Theme Of Beethoven," "Melodie Op. 42," "Ave Maria," "Romance In F Major Op. 50," "Zigenuerweisen," "Fair Rosemary," "The Girl With The Flaxen Hair," "Humoresque," and "Meditation From Thais."

The quality of the recording is excellent and anyone who is partial to sentimental solo violin should enjoy it no end. (W.N.W.)

* * *

**GREAT WALTZES OF VIENNA. The Vienna Orchestra conducted by Max Schonerr.
Mono, Festival FL31,698. (Also available in stereo SFL-931,698).**

Interest: Viennese waltzes.
Performance: Good.
Quality: Good.

If any orchestra should be able to capture the spirit of Viennese-style waltzes, it should surely be the Vienna Orchestra, conducted here by Max Schonerr and recorded, in the first instance, by Elite of Switzerland. In fact, the performance, while quite enjoyable, is merely typical of any large orchestra, playing this kind of music and with major emphasis on the string section.

I suspect that the mono version, which I reviewed, is a little short of tone colour by having been recorded in a rather dead acoustic environment. Most likely the stereo version would come through a good deal better.

However, I'm in danger of giving the wrong impression. If you like Viennese waltzes, you'll find the performance quite enjoyable, "dry" acoustics notwithstanding: "Citizen From Vienna," "Gold

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* * *

MARY POPPINS. Lawrence Welk. The complete vocal score. Featuring The Lennon, Sisters and the Lawrence Welk Singers. Stereo, Universal Record Club UP-722.

Interest: Popular musical.
Performance: Gay and musically excellent.
Quality: Outstanding.
Stereo: Outstanding also.

I may as well serve notice—this is a rave review!

The music itself is bright and tuneful. If you've seen the show you'll love it. If you haven't, you soon will.

And Lawrence Welk comes up with a performance as bright and tuneful as the music itself assisted, no doubt, by a formidable group of arrangers listed on the jacket. The Lennon Sisters receive special mention but the vocalists are all outstanding, with loads of presence and diction, and never a sour note to mar the performance.

On the "Hamilton" label, a new one to me, but from the Hollywood "Dot" studios, the quality is right out of the top drawer—clean, wide, well-spread sound that will delight the hi-fi fan.

The track titles: "Chim, Chim Cheree," "Step In Time," "I Love To Laugh," "The Perfect Nanny," "Supercali - fragil - istic - expiali - docious," "Jolly Holiday," "A Spoonful Of Sugar," "Sister Suffragette," "Feed The Birds," "The Life I Lead," "Stay Awake," "Let's Go Fly A Kite."

You owe it to yourself to buy this one. (W.N.W.)

* * *

THE LATIN SOUND OF HENRY MANCINI. R.C.A. "Dynagroove." Stereo LSP-3356. (Also available in mono).

Interest: Swinging Latin.
Performance: Typical Mancini.
Quality: Excellent.
Stereo: Good spread.

In this latest disc, Henry Mancini has used his arranging talents to create a sophisticated outpouring of melody over an infectious foundation of cross-rhythms. The end result may not be strictly traditional Latin but it is most impressive and distinctly Mancini in flavour.

The mood of the music ranges from the softly sentimental, as in "Baia," through to a driving, swinging jazz-Latin beat such as he establishes in "Senor Peter Gunn." For Manchini fans, a "must."

"Senor Peter Gun," "Baia," "Carnavalito," "Quiet Nights of Quiet Stars," "Vereda Tropical," "Guarare." "La Raspa," "The Breeze and I," "Preciosa," "Come to the Mardi Gras," "Perhaps, Perhaps, Perhaps," "Tico-Tico."

The audio quality is really first class and the stereo has a good, even spread. (K.W.J.)

* * *

STRAUSS WALTZ CONCERT. The Billy Vaughn Orchestra. Stereo, Universal Record Club UP-723.

Interest: Strauss waltzes.
Performance: Lilting.
Quality: Good.
Stereo: Normal.

Anyone with an ear for the classic waltzes of Johann Strauss should be a potential buyer for this disc—provided, of course, that they don't already possess a half-dozen other albums like it!

Billy Vaughn comes out front occasionally with his velvet-smooth sax, but the sound, most of the time, is that of a string orchestra, completely in the spirit of Viennese waltzes. All the traditional favourites are there — or so it seems:

"The Blue Danube," "Voices Of Spring," "Tales From The Vienna Woods," "Southern Roses," "Kiss Waltz," "Wine, Women And Song," "Artist's Life," "Vienna Life," "Du Und Du," "Treasure Waltz," "A Thousand And One Nights," "The Emperor Waltz."

Good value at the club price. A week-end present for the good lady? (W.N.W.)

* * *

DANCE LATINO. Perez Prado and his Orchestra. R.C.A., Stereo, LSP-3330. (Also available in mono).

Interest: Latin rhythms.
Performance: Torrid.
Quality: Very good.
Stero: Fair spread.

Perez Prado is the bandleader who came up with those interesting renditions of "Cherry Pink and Apple Blossom White," and later "Patricia," both of these being million - seller recordings which set new sound trends. If you liked those discs then you would find much to please you in this latest album.

The music of Perez Prado has such a well-defined Latin rhythm that it gives a pulsating, danceable beat to any song it offers. Even the sentimental old favourite "Peg O'My Heart" becomes freshly scintillating under the influence of this bandleader.

The titles: "Adios Pampa Mia," "One Night," "Fast Goodnight," "Ramona," "Peg o' My Heart," "Cricket Serenade," "La Rubia," "Cucara, Cha Cha Cha," "Be True To Me," "Surfside 6," "Abulaby Laby," "Keep Dancing."

The audio quality is very good and the stereo has a fair spread with occasional emphasised separation. (K.W.)

* * *

FEELING GOOD. Xavier Cugat and his Orchestra. Stereo, Festival SDL-931,743. (Also available in mono DL-31,743).

Interest: Hit tunes, Latin accented.
Performance: Tops.
Quality: Clean.
Stereo: Separation emphasised.

Say the jacket notes about Xavier Cugat: "No one has so dominated an area of popular music as has the charming, talented 'Cugie' — master of the Latin-accented beat."

To counter any possible doubts about his acceptance "Cugie" could point to the traditional popularity of his tango orchestra at the Coconut Grove and the Waldorf-Astoria, the tunes written expressly for him ("Begin The Beguine" — "Frenesi" — "Brazil" — "Besame Mucho"), to no fewer than 18 M-G-M musicals, to radio, television, albums—the works!

Here, drawing heavily on electronically aided instruments (organ, guitar, marimba and who knows what else) he presents bright arrangements of, mainly, stage and screen hits. Incidentally, while the numbers are on separate tracks, the breaks are bridged, so that the music never stops:

"Downtown," "Hello, Dolly," "Mexican Pearls" "Fiddler On The Roof," "And I Love Her," "La Bamba," "Feeling Good," "Cast Your Fate To The Wind," "It's Not Unusual," "Goldfinger," "Game Of Love," and "Chim, Chim, Cheree."

As indicated above, the quality is good but the most notable feature of the disc is the channel separation, which Xavier Cugat exploits for maximum musical effect. (W.N.W.)

* * *

MILITARY MARCHES OF JAPAN, performed by the New Pacific Brass Band and The Central Brass Band of the Ground Defence Forces. Stereo, King Records (Festival) SFL-931,764.

Interest: Tuneful music for military bands.
Performance: Competent.
Quality: First class.
Stereo: Normal spread.

Anyone who has reservations about the quality of Japanese music and its impact on those accustomed to the idioms of European music can dismiss their doubts. This disc reveals that not only is the music completely acceptable to Western ears, but that it is also imbued with a wealth of pleasant melody.

Fourteen numbers are featured on this disc (the last being the Japanese national anthem "Kimigayo") and playing time extends to nearly 55 minutes. The

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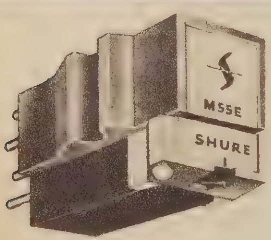

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music is delightfully tuneful, with immediate appeal. The slight oriental influence noticeable here and there adds to the interest.

Despite the title of the disc, it is difficult to imagine that all the numbers are intended for marching. One or two sound as though they would be suitable for dances of the "Lancers" variety. Particularly interesting is the third number on the second side ("Aibako") which begins with a sinuous theme for woodwinds and jig-jog accompaniment from the brass. With suitable words added, this could easily become a popular song. The frequent use of minor keys in somewhat unusual in march music, and suggest that Japanese composers are partial to this mode.

The performances are somewhat more restrained than is usual with Western bands and lacks some of the exuberance diplayed by the Americans, as also the somewhat pompous quality often present in British performances. The result is that the dynamic range is somewhat restricted, but I did not find this at all a disadvantage. I venture to suggest that brass band performers who hear the catchy tunes on this disc will be asking where they can obtain musical scores.

While I pass the disc with full marks, I must add a word of complaint about the sleeve notes, which are quite unhelpful. The Japanese titles are not translated, nor are the composers credited. The music is dismissed in about 150 word which refer vaguely to "world famous" marches. The remainder of the available space is devoted to a detailed description of the recording process used for "Super Dynamic Sound" and the equipment with which it is achieved. (H.A.T.).

★ ★ ★

SEGOVIA RECITAL. Suite in Modo Polonico by Alexandre Tansman. Suite Compostelana by Federico Mompou. Two Miniatures by Maria Esteban De Valera. Festival, Stereo SDC-931,771, Mono DC-31,771.

Interest: Segovia and 20th century guitar music.

Performance: Impeccable.

Quality: Excellent.

Stereo: No noticeable spread (naturally!)

Another treasure for Segovia fans, and a feast of pleasure for all lovers of classical guitar. To comment on the performance of the world's acknowledged master of the guitar would be presumptuous. One can only wonder at the superb technique, and at the ability to project such a range of musical expression from plucking strings.

But what of the music? It is all of recent vintage (except one movement of the Tansman Suite which was composed in the early 1920s) and many people who fight shy of twentieth-century music might feel inclined to give this record a miss. This would be a pity, since this is music firmly rooted in the traditions of melody and classical harmony. For some reason, modern compositions for the guitar are largely devoid of the clashing harmonies, dissonances and jerky themes which characterise so much modern music. Could this be because the influence of Segovia is so strong in this field that people write music not for guitar but for Segovia? And that thereby they are influenced by the Master's tastes, which seem to lean towards the classical period of the seventeenth and eighteenth centuries?

The Tansman Suite consists of ten short pieces which, the composer has said, were inspired by the ancient court dance of Poland. All except one (Reverie) bear the titles of these old Polish dance forms, and the leisurely pace of the music is certainly more suited to the seventeenth than the frenetic twentieth-century. Although written specially for the guitar, the music is oddly reminiscent of the transcriptions of classical works with which Segovia first established the claims of the guitar as a serious musical instrument.

Suite Compostelana is quite delightful. The music is refreshingly original, yet very melodic, and full of gentle cadences. The only piece which disturbs the essentially tranquil atmosphere of the suite is "Recitativo," with its dominating sternly masculine theme in the lower register. The suite derives its name from the ancient Spanish cathedral city of Santiago de Compostela, where Segovia and some of his colleagues conduct an annual "summer school" for students of the guitar, accompanied by numerous recitals. Despite the origin of the work, and the Spanish nationality of the composer, the work has none of the characteristic Spanish flavour, probably because the so-called Phrygian cadence common to so much Spanish music is entirely absent in this work.

The recital concludes with two charming miniatures in contrasting moods by Segovia's close friend of long standing, Maria Esteban de Valera. The first, entitled "Nana," is obviously a musical portrait of a gentle feminine personality; while "Intermezzo" has a confident, striding theme. (H.A.T.)

★ ★ ★

AS I REMEMBER HAWAII. Alvino Rey accompanied by selected Hawaiian musicians. Dot (Festival) 12-inch Stereo, SZL-931,730. (Also available in mono ZL-31,730.)

Interest: Hawaiian guitar.

Performance: Good.

Recording: Excellent.

Stereo Quality: Fair spread.

When I sat down to reveiew this record, I was "preconditioned" by the statement on the cover, "Strictly Instrumental." However, I had no sooner settled down to the mood of the excellent instrumental sound than I was disturbed by vocal efforts, presumably of the Hawaiian musicians. And this happens on every track.

Maybe it was the effect of the "preconditioning," but I didn't get over the feeling that this particular record would have been better had it been true to label. The tunes featured are "Song Of The Islands," "Lovely Hula Hands," "Blue Hawaii," "Little Brown Gal," "Sweet Someone," "Hawaiian War Chant," "The Hukilau Song," "Sweet Leilani," "My Little Grass Shack," "Beyond The Reef," "The Hawaiian Wedding Song," and "Aloha Oe."

Except for the above reservations, the performance of the artists is good and the relaxing mood of Hawaiian music quite enjoyable. (K.W.)

★ ★ ★

THE BLACK WATCH R.H.R. OF CANADA. Directed by Lt. H. C. Eagles, Pipe Major W. Gilmour and Drum Major M. Phelan. Stereo, Decca SKLA-4650. (Also available in mono LKA-4650).

Interest: Music of Scotland.

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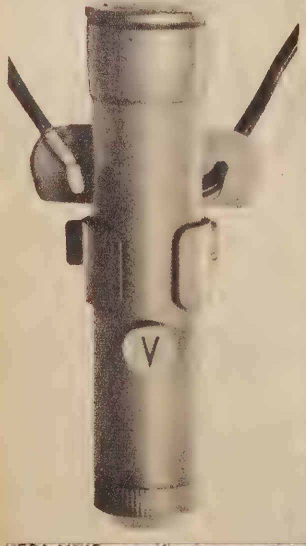

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Size: 5" x 1" diameter.
Weight: 7½ ozs.

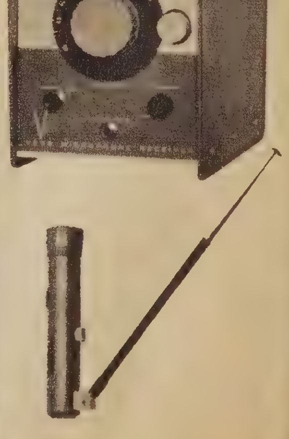
MATCHING RECEIVER (AC OPERATION) SPECIFICATIONS

Output: Two balanced or unbalanced outputs, high level (line) and low level (mike). Latter may be fed to high or low impedence inputs.
Frequency response: 20-20,000 c/s (flat).
Signal/Noise ratio: Better than 60 db for plus or minus 20 kc deviation/unmodulated carrier.
Size: 6¾" wide x 9⅜" high x 12⅝" deep.
Weight: 17½ lbs.

The highest and lowest tones picked up by the VEGA-MIKE are accurately reproduced by the VEGA receiver. Noise free FM circuitry provides sensitive and drift-free performance. Automatic frequency control compensates for temperature and frequency changes. Built-in speaker acts as PA system for small groups.

Accessories include ■ Helmet to extend range of hand held Vega-Mike ■ Push-to-talk unit ■ Rack mount adaptor ■ Remote Control Carrier Relay.

Contact any office or representative of Simon Gray Pty. Ltd. for complete technical information on the VEGA-MIKE and the matching VEGA receiver.



Performance: Good.
Quality: Clean, open-air sound.
Stereo: Well spread.

The music on this album is in line with what one might expect from a Highland regiment, recruited from Canadians and performing in Europe as part of the NATO forces!

It begins and ends with tracks in which the pipes combine with the regimental band to present traditional Scottish airs. In my home this provoked some very irreverent speculation as to whether it spoiled the band, improved the pipes or, more significantly, demonstrated that the pipes could play recognisable music after all.

Four other tracks are given over completely to the pipes and drums and, here again, a remark was heard that the tunes were still recognisable. Could this be the Canadian influence?

And finally, four other tracks by the regimental band are devoted to the music of Scotland, played in the manner of a regimental band, "uncomplicated" by pipes.

And thus having revealed a personal lack of accord with the sound that has driven so many Scots from their native land, I must admit that there may be quite a few suffering sufficiently from nostalgia to want to hear the sound again. (W.N.W.)

* * *

COMMAND PERFORMANCES OF TONY MOTTOLA, Guitarist. Originated and produced by Enoch Light. Command 12-inch stereo, SNDL-931791. (Also available in mono NDL-31791.)

Interest: Popular guitar.
Performance: Sparkling.
Recording: Excellent.
Stereo Quality: Good spread.

Tony Mottola fans will need no urging to buy this record. We do suggest, however, that those not familiar with his work spare the time to sample the versatility of this outstanding guitarist. Associated in earlier days with Frank Sinatra, Tony later became accompanist to Perry Como and is still associated with this artist.

The mood varies through the record from the romantic to happy foot-tapping rag. Accompanied by other fine "Command" artists, Tony's skilled performance is right out of the top drawer!

Tunes played are "Boulevarde of Broken Dreams," "If I Had You," "Neapolitan Tarantella," "Love Song Medley," "Twelfth Street Rag," "Always and Always," "Let's Fall In Love." "The Poor People of Paris," "You Go To My Head," "Carnival of Venice," "Lullaby De Espana," and "What's New."

This should be a good one for parties and for personal listening. The pressing is excellent and the stereo well spread. (K.W.)

* * *

WALTZ SONGS OF THE TWENTIES. Kathleen McCormack, vocal, with orchestra directed by Noel Gilmour. Mono, Columbia Encore Series 330 EX-9139.

Interest: as per the title.
Performance: Appealing.
Quality: Good.

Kathleen McCormack was born in Ireland in 1929 but came to this country at a very early age, and is far more Australian than either her name or her birthplace would suggest.

While she has built up quite a reputation as a folk singer and also has a current album of Irish songs, her choice here is a group of songs that will have strong nostalgic appeal. This is all the more true because the items are sung — and sung very well — rather than played as is usually the case:

"Always," "Alice Blue Gown," "What'll I Do," "When I Lost You," "Stars Are The Windows Of Heaven," "Missouri Waltz," "The Song Is Ended," "I'm Forever Blowing Bubbles," "Your Eyes Have Told Me So," "Three O'Clock In The Morning," "Let The Rest Of The World —Together — Memories" and "Till We Meet Again."

Have a listen to this one if the music appeals. It's pleasant and, no less to the point, it's on an economy label. (W.N.W.)

* * *

SEE WHAT TOMORROW BRINGS. Peter, Paul and Mary. Stereo, Warner Bros. (Australian Record Company Ltd.) WF-1615.

Interest: Famous folk trio.
Performance: Smooth, capable.
Quality: Excellent.
Stereo: Good separation where sought.

Most of us probably know Peter, Paul and Mary best by their television and stage appearances. And watching them, one can only be partly aware of the actual sound they produce.

But listening through an album, the visual subsides and the sound takes over. And what excellent sound it is — the precision of the guitar accompaniment, the deep throb of the bass and the excellence of the vocal, whether solo or harmony. No wonder the group has such appeal.

The tracks on this disc:

"If I Were Free," "Betty And Dupree," "The Rising Of The Moon," "Early Mornin' Rain," "Jane, Jane," "Because All Men Are Brothers," "Hangman," "Brother, Can You Spare A Dime," "The First Time Ever I Saw Your Face," "Tryin' To Win," "On A Desert Island," "The Last Thing On My Mind."

If you're at all partial to Peter, Paul and Mary, you'll find this a thoroughly enjoyable disc. (W.N.W.)

* * *

THE SOUND OF CHILDREN. St. Margaret Mary's Girls' Choir, conducted by Sister Nathaniel. Mono, Festival FL-31-746.

Interest: Children's choir.
Performance: With the charm of children.
Quality: Normal.

Founded as recently as 1962, from the girls of a Catholic primary school in Merrylands, Sydney, The St. Margaret Mary's Girls' Choir has won a first prize in the City of Sydney Eisteddfod, and other prizes in the St. George District Eisteddfod; it was featured on the Johnny O'Keefe Show, Christmas edition, and later in the "Wonderful World of Leslie Uggams"—the latter for world showing on television.

In the face of these successes it would be unthinkable that this album—their second for Festival—could be anything but enjoyable.

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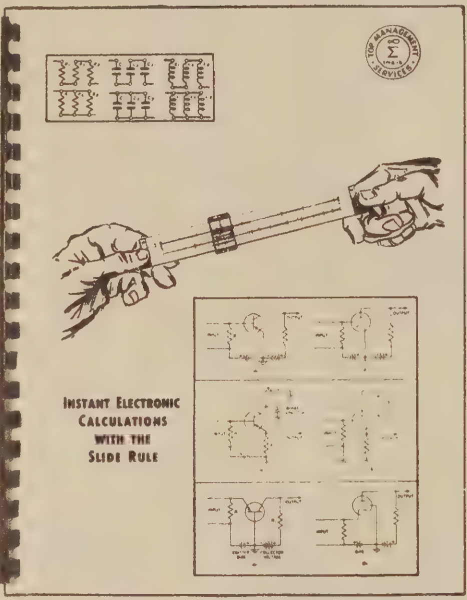
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In saying this, however, I have viewed the album for what it is—a program by children for those with an interest in the sound of children.

The songs, which the choir sings so well in its own way are: "The Happy Wanderer," "Daydreaming," "Balulalow," "Down By The Sally Gardens," "Old Black Joe," "The Cockle Gatherer," "Jeannie With The Light Brown Hair," "Chim Chim Cheree," "Marianina," "Little Donkey," "Australia, My Country," "Sleep Then My Princess," "The Hiking Song," and "The Spinning Wheel." (W.N.W.)

★ ★ ★

A TV REQUEST PROGRAM. Bill Newman, Vocal. Mono, Festival FL-31,753.
Interest: Good, straight singing.
Performance: Excellent.
Quality: Good.

The continuing popularity of Bobby Limb's weekly TV show "The Sound Of Music" is clear indication of the large audience which likes good, straight, popular music, minus the guitars and gimmicks of the current teenage idols. Bill Newman is one of the artists who give expression to this kind of music on the show.

A New Zealander by birth, Bill sings the numbers exactly as you would expect of someone with a background of stage musicals, competently and with an atmosphere of romance keyed to music and footlights.

The songs, according to the jacket notes, are those which he is requested most frequently to sing on television: "Can I Forget You," "Marcheta," "Golden Earrings," "Hills Of Home," "Try A Little Tenderness," "Climb Ev'ry Mountain," "Indian Summer," "Because," "Did I Remember," "Sylvia," "Ramona," "Duna."

Unless I miss my guess, this should be a very popular album. (W.N.W.)

★ ★ ★

MUDDY WATERS SINGS "BIG BILL" (The songs of "Big Bill" Broonzy). Chess, Stereo, CHLS-221.
Interest: Blues vocals.
Performance: Good.
Quality: Good.
Stereo: Separation emphasised.

Out of the 360 odd blues numbers written by "Big Bill" Broonzy, Muddy Waters has chosen what he considers to be the 10 best for this disc. These numbers he sings in his usual open-voiced-shouting style with some able backing from piano, drums, guitar and, if my ears don't deceive me, two mouth organs.

Muddy is a really good blues singer but his style is something of an acquired taste with a wider acceptance in the U.S.A. than in this country. If you have never heard him before you would be wise to sample a few tracks from the disc before buying. As a sampler I suggest "Lonesome Road Blues."

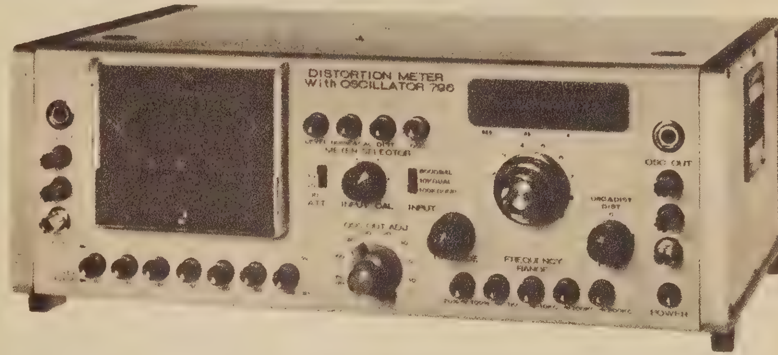
The titles: "Tell My Baby," "Southbound Train," "When I Get To Thinking," "Just A Dream," "Double Trouble," "I Feel So Good," "I Done Got Wise," "Mopper's Blues," "Lonesome Road Blues," "Hey, Hey."

The audio quality of the disc is good but does not quite qualify for the "excellent" label. The stereo separation is distinctly emphasised. (K.W.J.)

TRADE REVIEWS AND RELEASES

NOISE & DISTORTION METER

Pictured is the Shibaden Type 796 Noise and Distortion Measuring Set, a fully transistorised instrument featuring a wideband level meter and a low distortion oscillator frequency interlocked with harmonic distortion measuring circuitry. A most versatile instrument, it will be of interest to all concerned with accurate measurement at audio frequencies. It was sent for review by 16 Millimetre Australia Pty. Ltd., of 49 Market Street, Sydney.



THE level metering section of the type 796 features a large 4½in rectangular-cale movement having standard 0-10, short-ned 0-3 and dB scales. The scales are rinted in light lettering upon a dark back-round, and are exceptionally easy to read. he meter is well damped, which further mproves reading convenience when work-ng with low-level signals.

Nine different measuring ranges are pro-ided, covering the range + 20dBv to –70dBv in 10db steps. The ranges below dBv are selected by push buttons beneath he meter, while those above 0dBv are btained using a two-step attenuator. The nput impedance of the metering section nay be set to 600 ohms, 10K or 100K, the ast named being unbalanced with respect o earth while the other two may be made alanced or unbalanced as desired. requency range of this section is within .5dB from 20cps—60KC for 600 ohm and 0K inputs, and 20cps — 600KC for the 00K input. Accuracy is within 5 per ent of full scale, on all ranges.

The oscillator section of the instrument overs the range 20cps—200KC. Although he frequency of operation may be set to hree digits using concentric controls the ignificance of the third digit will vary ather widely over the range as the requency accuracy is quoted as 3 per cent. he decade used is selected by means of ush buttons. The output impedance of he oscillator is 600 ohms, and may be bal-nced or unbalanced to earth as required. Output is adjustable from + 10dBm to –70dBm, with constant output within .5dB over the frequency range and less han 0.1 per cent THD from 50cps to 100-C (less than 0.2 per cent THD from 20-ps—200KC).

The distortion measuring section is requency interlocked with the oscillator ection, although verniers are provided for ccurate nulling despite interlock errors. For 00K input impedance the total frequency ange measured is 20cps—600KC (funda-nental nulling to 200KC); for 600 ohm and 0K input impedance the upper limit falls o 60KC. T.H. distortion may be read own to 0.1 per cent for signals between –10dBv and +20dBv, with an accuracy f 5 per cent of full scale for each range lowest range 0.3 per cent full scale).

The oscillator/distortion measurement requency in use is indicated by a row of old-cathode indicator tubes, which makes or very convenient operation. However the ubes do not function when the instrument s operated from batteries (it requires 2 x 4V batteries, 80mA and 90mA). When perating from batteries the control markings must be used; however these are quite unambiguous.

The instrument is not small — it measures 15in x 17in x 6½in overall, and weighs about 31 pounds—but it is very sturdily made. The case is finished in grey lacquer, with a light grey front panel and engraved lettering.

Tested in our laboratory, the model 796 proved a most versatile unit. The controls were found to be conveniently situated and easily manipulated, and the layout lent itself to rapid measurement. The frequency indication proved particularly convenient.

The inter-range steps on both the metering and oscillator attenuators were found consistently accurate at 10dB, and the frequency response of both easily met the specifications. Oscillator distortion was very low indeed; we couldn't measure it. The minimum readable distortion was 0.08 per cent—not quite as low as one might perhaps expect or require for highly critical laboratory measurement, but adequate for the majority of applications.

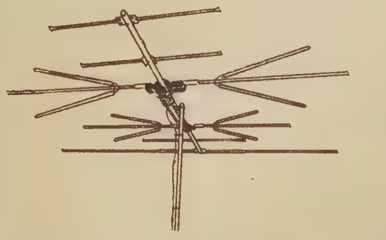
In all, then, a most versatile and businesslike instrument, capable of rapid and accurate measurement.

Price of the Shibaden model 796 is quoted at £686/11/-. Availability is 6 weeks ex factory. Further information can be obtained from the Studio and Electronics Division, Sixteen Millimetre Australia. (J.R.)

TRADE RELEASES—IN BRIEF

FERRIS BROS. PTY. LTD. is manufacturing a new, variable attenuator which provides up to 35dB of attenuation (continuously variable) over the frequency range 54-104MC (TV channels 1 to 4). The unit, called the Channel Master low band variable attenuator Type 6121, is potted in epoxy resin and plastic encapsulated so that it is suitable for outdoor or indoor use. Mast mounting facilities are provided. Retail price, including tax, is £1/7/.

CHANNEL MASTER PTY. LTD. has released details of three new aerials which have been added to the "Channel Master" range. M732 Jetray TV antenna is a seven-element in-line composite Yagi design with vertical impedance bars in the single folded dipole. It is designed for near fringe and difficult areas served by Channels 3 and 6, or 3 and 7, with horizontal or vertical polarisation. Excellent gain and directivity are achieved on these channels by the use of a special folded dipole and both co-linear and centre inductance loaded director elements . The retail price is £7/15/.



M733 Super Jetray TV antenna is a 12-element version of the M732, intended for fringe area use. It retails at £12/15/.

Super Coloray Model 3111 (illustrated) is a six-element in-line TV antenna with "Super Crossfire" type director system as twin driver active elements. It is particularly suitable for difficult "ghost" areas, local or semi-fringe, and can be used for master antenna for multiple installations. The makers claim it has excellent performance on Channels 0 to 11, with front to back power ratios up to 30-1. An inbuilt balun provides feed points for 300 ohm balanced line or 75 ohm co-axial line. Retail price is £8/14/6.

WARBURTON FRANKI INDUSTRIES (MELBOURNE) PTY. LTD. has been appointed wholesalers for the whole range of Telecomponents replacement components for TV and radio receivers. Business premises are located at 220 Park Street, South Melbourne (Phone 69-0151).

MASSE BATTERIES, of Padstow, N.S.W., have announced the appointment of Mr J. E. Davis as N.S.W. State manager for Associated Battery Makers of Australia Pty. Ltd. In his new position Mr Davis will be responsible for the sales, distribution and warehousing of all the company's products in N.S.W. Masse Batteries will continue to operate as a division of Associated Battery Makers of Australia, and will distribute automotive batteries from branches at Artarmon and Parramatta. Alkaline and industrial batteries will continue to be distributed from the company's head office at Padstow.

AMALGAMATED WIRELESS VALVE CO. PTY. LTD. says another breakthrough in "overlay" technology has resulted in the development of a new generation of transistors delivering 1W and 1.8W output across a broad band of frequencies from 27MC to higher than 400MC. (The "overlay" technique employs a number of individual emitter sites connected in parallel and used in conjunction with a single base and collector region.)

The first of the new range is Type 2N3866, with a guaranteed minimum output power of 1W at 400MC (10dB gain) from a 28V supply. Suggested applications for the 2N3866 are as pre-driver, driver and output transistor for the range of frequencies referred to above.

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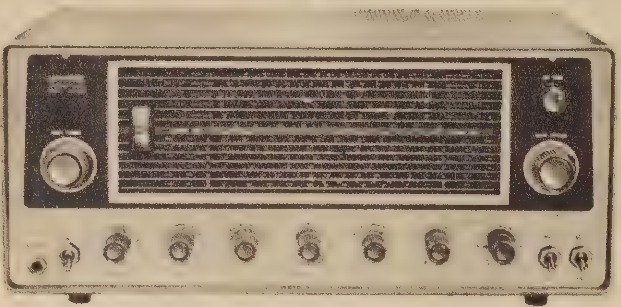

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The HA-225 features full amateur band coverage of 80 through 6 metres plus Marine Beacon Band. Special filament transformer provides continuous filament voltage to oscillator and mixer tubes . . . maintains critical frequency stability . . . prolongs tube life . . . reduces warm-up time. Sensitivity is .5 Microvolt for 10 db s/n ratio. Selectivity is variable from 60 db to 93 db in Q-Multiplier operation with plus or minus 10 KC detuning. Calibrated electrical bandspread on amateur bands 80 through 10 metres (6 metres is tuned with main tuning controls on expanded scale). Other features include antenna trimmer, built-in "S" meter, tape recording jack, and remote control socket for simultaneous control of HA-225 with a transmitter. Front Panel Controls: AF Gain, RF Gain, 4-position Function Switch, BFO Frequency, Band Selector, Q-Multiplier Selectivity, Q-Multiplier Frequency, Band Spread Tuning, Main Tuning, Antenna Trimmer, Power On-Off Switch, MVC-AVC Switch, Rec-Send Switch, and Headphone Jack. IF—455 KC Audio Output—1.5 Watts. Output impedance—8 and 500 ohms (speaker optional extra). Tubes 4 6AQ8, 3 6BA6, 2 6BE6, 1 6BL8, 1 6AL5, 1 6AQ5, 1 OA2 plus 6CA4 rectifier. For 220-240 VAC.

Model HA-225. Less Calibrator Crystal, Stock No. 99-2523. £119/10/-

Optional Calibrator Crystal, 100 KC. Type HC/13U. Stock No. 40-0901. £4/9/6

Model HE-48 Matching 3in x 5in Speaker. Stock No. 99-2532. £4/17/6

99-5011 £18/15/-

A handy slide out metal tray contains tube charts which facilitate rapid selection of test settings. Metal case is attractively finished in cream and steel grey. Completely portable—weighs only 6lb. Supplied with plastic carrying bag. For 220-240 VAC.

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ELECTRON TUBE DISTRIBUTORS PTY. LTD., 523 Old South Head Rd., Rose Bay, N.S.W. Phone 37-6472.
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MACK'S ELECTRONICS, 199 Rundle Street, Adelaide, S.A.
WINDSOR SERVICES, Smith Street, Darwin, N.T.

AMALGAMATED WIRELESS VALVE CO. PTY. LTD. has available a technical brochure containing specifications and operational data for the RCA-2N3733 epitaxial silicon n-p-n planar transistor. The device is designed for VHF/UHF use, as Class A, B or C amplifier, frequency multiplier or oscillator. Copies of the brochure are available from AWV, 47 York Street Sydney.

The company also announces that it has in production two new travelling wave tubes Types N1055 and N1056. These are wideband power amplifiers with a nominal gain of 37dB, working power output of 10W and typical saturation output power of 16W. Type N1055 is designed for operation in the frequency range 5.6 to 7.2GC; and the N1056 for 3.6 to 4.2GC. These tubes have been developed primarily for microwave communications applications. Specific features are extremely low AM/PM conversion and low noise factor, enabling cross-talk and distortion in multichannel links to be kept to a minimum.

Finally, they wish to advise that the merchandising activities formerly carried on at 47 York Street, Sydney, have, since October 1, 1965, been consolidated with the company's manufacturing activities at 348 Victoria Road, Rydalmere, phone 638-0411.

FERRIS BROS. PTY. LTD. announce that they have appointed Mr F. J. Randell to the executive staff. Mr Randell is the Technical Liaison Officer for the Telecomponents and Industrial Divisions of the company.

AUSTRALIAN GENERAL ELECTRIC PTY. LTD. announce that G-E semiconductor devices are available to the trade in small quantities from Watkin Wynne Pty. Ltd., of 32 Falcon Street, Crow's Nest N.S.W. Thus devices such as the ST-2 "Diac" symmetrical breakdown diode and the SC40-D "Triac" silicon controlled AC switch, as used in the "Vari-watt" project (this issue, page 41), may be ordered from Watkin Wynne via readers' usual parts supplier.

Trade prices for the ST-2 and SC40-D devices are 28/6 (2.85 dollars) and 78/- (7.80 dollars) respectively, plus 12½ per cent tax. Pictured also are economy unijunction transistors type 2N2160 and 2N2646, available at 19/- (1.90 dollars) and 13/6 (1.35 dollars) respectively plus 12½ per cent.

F. W. BELL, INC., manufacturers of magnetic instrumentation equipment, announce the release of a "magnetic reaction analyser." An eddy-current metal testing machine employing a Hall transducer, the new instrument will identify metals and alloys, measure metal thickness, detect flaws and cracks in metal sheets and films, and accurately measure the thickness of non-metallic coatings on metals. (Australian representatives for F. W. Bell are Tecnico Electronics Pty. Ltd., 53 Carrington Road, Marrickville, N.S.W.).

EMERSON AND CUMING, INC., of Canton, Mass., U.S.A., advise that they have available a comparative property chart which gives a quick comparison of important properties of clear Stycast epoxy casting resins. Characteristics listed include colour, cure temperature, pot life, maximum weight for one hour, hardness and maximum use temperature.

"PICKERING V-15" STEREO CARTRIDGES

Well known in America, the "Pickering" V-15 series of stereo magnetic pickup cartridges are now available in Australia. Two of the series were recently sent to our laboratory for review by the Australian agents, Goldring Engineering (A'asia) Pty. Ltd., of 443 Kent Street, Sydney.

PICTURED is the V-15/AM-1 cartridge, having a 0.7-mil conical diamond stylus. The V-15/AME-1 is identical in appearance, apart from the use of a different coloured plastic for the stylus surround; it features a 0.3 x 0.8-mil elliptical stylus.

Both cartridges have a rated frequency response of 20cps—20KC, with a rated crosstalk rejection of 25-35dB. They have medium output level — 1.5mV/cM/S — and are intended for the usual 47K load.

Quite light in weight (5 grams), they are suitable for all arms having standard ½in-spaced mounting screws.

Quoted compliance of the AM-1 stylus is 6 micro-cM/Dyne in both directions, while that of the AME-1 is a commendable 20 micro-cM/Dyne. The tracking force recommended for the AM-1 is ¾-3 gms, and that for the AME-1 is ¾-1½ gms.

Both cartridges are of the moving-magnet type and, as a result, the stylus assemblies are easily removed and replaced. It may be noted, incidentally, that the differences between the cartridges would appear to lie wholly in the stylus assemblies. Thus it would no doubt be possible to convert from one to the other simply by purchasing the corresponding stylus assembly.

Tested in our laboratory using the VSD-100 test record both cartridges gave a very good account of themselves. The response of both units was flat within 2dB from 30cps — 15KC, the range covered by the test record; for both units the stereo channels were balanced within 0.5dB over most of the audio range. Crosstalk rejection was more than 20dB over most of the range, falling to a minimum of 15dB at 15KC in the neighbourhood of the stylus resonance.

In tests with the overload tracks of the VSD-100 and with tracks on other discs noted for their ability to cause tracking embarrassment, the AM-1 tracked perfectly and with no audible distortion at 0.75 gm playing force. The AME-1 with its elliptical stylus did even better, giving the same performance at only 0.5 gm.

Apart from enabling the AME-1 to track without distortion at a lower playing force the elliptical stylus gives it a subtle but just-discernable edge in clarity. This is most noticeable in complex polyphonic music.

Prolonged listening tests with the AME-1 used in the reviewer's home stereo system confirmed these results. The AM-1 and particularly the AME-1 are high-grade performers, and give particularly smooth and clean reproduction.

Considering this performance, it comes as a most pleasant surprise to learn that the cost of the cartridges is quite modest: retail price of the AM-1 is quoted as £13 (26 dollars), while that of the AME-1 is £19 (38 dollars). Replacement stylus assemblies are a little expensive, though, as with the moving-magnet system they contain a major part of the "works": prices are £7/10/ (15 dollars) for the AM-1 assembly and £13/7/ (26.70 dollars) for the AME-1 assembly. (J.R.) ■

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AMATEUR BAND NEWS AND NOTES

International Telecommunication Union

This organisation, known to amateurs throughout the world as the I.T.U., made a number of important decisions at the ninth Plenipotentiary Conference.

By Pierce Healy, VK2APQ*

THE conference opened at Montreaux, Switzerland, on September 14, 1965, and concluded on November 12, 1965. Although the discussions were on administrative matters and no frequency allocations were reviewed, just what effect the decisions will have on the amateur service cannot be assessed at the present time.

The main task of the conference, which lasted nine weeks and was attended by representatives of about 120 member countries, was the revision of the previous convention drawn up by the preceding Plentipotentiary Conference in Geneva in 1959. The new convention, like its predecessors, govern the operation of the ITU and will enter into force on January 1, 1967.

In one of its major decisions, the conference agreed in principle on a constitutional charter to replace the convention, and instructed the Administrative Council to set up a study group to prepare the draft of such a charter in sufficient time for it to be distributed to member countries at least one year before the next Plentipotentiary Conference which is to be held in Geneva in 1971.

In a series of resolutions, the conference called for methods of improving technical co-operation, the improvement of Union facilities for providing information and advice to new or developing countries, the application of telecommunication science and technology in the interests of such countries, and the continuance and increase of seminars.

Another resolution, concerning telecommunications and the peaceful uses of outer space, stated that it was highly desirable that all countries should have equal opportunity to use space radiocommunication facilities. The conference also stated its opinion that centres for the study of space communications should be established as soon as possible in the different regions of the world.

The convening of certain special conferences was agreed on, notably a World Administrative Radio Conference for the Maritime Mobile Service and a Regional Administrative Conference for Latin America.

The conference made certain changes in the structure of the organisation, notably by increasing the number of members of the Administrative Council from 25 to 29 and reducing the number of members of the International Frequency Registration Board (IFRB) from 11 to five.

It elected Dr Manohar Balaji Sarwate, of India, as the new Secretary-General to replace Mr Gerald C. Gross, who retired at the end of 1965. It also elected Mr Mohamed Mili, of Tunisia, as Deputy Secretary-General.

The new members of the Administrative Council, listed under the five ITU Regions, are:—

(for the Americas); Argentine Republic; United States of America; Canada; Mexico; Republic of Venezuela; and Brazil.

(for Western Europe): France; Italy, Switzerland (Confederation); Federal Republic of Germany; United Kingdom of Great Britain and Northern Ireland; and Ireland.

(for Eastern Europe and Northern Asia): Union of Soviet Socialist Republics; Federal Socialist of Yugoslavia; and People's Republic of Poland.

(for Africa): Kingdom of Morocco; Republic of Dahomey; Federal Republic of Nigeria; Democratic and Popular Republic of Algeria; Ethiopia; Malagasy Republic; and Uganda.

(for Asia and Australasia): Japan; Commonwealth of Australia; Republic of India; Pakistan; Lebanon; Kingdom of Saudi Arabia; and China.

The new members of the IFRB who were also elected by regions and who will enter into office on January 1, 1967, are:—Mr Fioravanti Dellamula, of the Argentine Republic; M. Rene Petit, of France; Mr Ivan Petrov, of the Union of Soviet Socialist Republics; Mr Abderrazak Berrada, of the Kingdom of Morocco; and Mr Taro Nishizaki, of Japan.

Prior to the close of the Convention, the new 29 Member Administrative Council met and elected as Chairman of its Twenty-first Session, which will take place from May 9 to June 4, 1966, Mr Rudolf Rutschi of the Swiss Confederation. As Vice-Chairman it elected Mr Proinnsias L. O'-Colmain of Ireland.

Among other decisions taken by the Council was agreement that the African LF/MF Broadcasting Conference, which met in Geneva in October 1964 but was unable to complete its work, should reconvene in that city on September 19, 1966, for three weeks.

In a Press release dated September 21, the following news was released.

"The Republic of South Africa was today excluded from the Plenipotentiary Conference of the I.T.U. meeting in Montreux, Switzerland, on a proposal by the United Arab Republic.

"At this morning's session, the United States of America put forward a proposal that 'This Conference is not competent to take the action proposed in the resolution of the United Arab Republic (Document No. 110).' Document No. 110 contained the resolution for the exclusion of South Africa from the Conference.

"The United States proposal was defeated by 58 votes to 51 with two abstentions.

"Thus, at its afternoon Plenary Meeting, the Conference proceeded to vote on the resolution proposed by the United Arab Republic, which was adopted by 59 votes to 27, with 7 abstentions. 15 countries did not participate in the vote."

From the Amateur Service point of view, only time will tell what implications this move will bring about. Will it mean a disregard for frequency allocation agreements on the part of South Africa? Will it affect the status of the Amateur Service in that country? Let us hope it will not.

It is unfortunate that there is so much apathy on the part of some amateurs as far as ITU matters are concerned and who do little to support their recognised Amateur organisations in providing funds to ensure representation at ITU Conferences dealing with Amateur Service frequency allocations.

SOUTH INDIA AMATEUR RADIO

Congratulations go to the Bangalore Amateur Radio Club for their fine gesture in producing a commemorative issue of their club magazine "SIRAN" for the International Telecommunication Union Centenary.

Several messages of greeting and expression of good wishes to the I.T.U. on the occasion of its centenary, were recorded.

Included were those of the President of India, Dr S. Radhakrishnan, the president of the Amateur Radio Society of India, VU2RB, and the president of the Amateur Radio Club at Bangalore, VU2JR.

Among the 20 interesting articles were several dealing with the International Telecommunications Union, one on short-wave listening by Ross Erwin, president, New South Wales division W.I.A. S.W.L. Group, and one on the International Amateur Radio Union.

As the importance of the International Amateur Radio Union may not be known or appreciated, some extracts from the above article are quoted:

"Membership of the I.A.R.U. is open to the national amateur radio organisations. Not more than one society in a country will be admitted into the I.A.R.U. One of the member societies is nominated as the Headquarters Society. Since there is no provision for funds in the I.A.R.U. constitution, the expenses of the Union are met by the Headquarters Society. Ever since its inception, the A.R.R.L. has been the H.Q. society. Officers of the I.A.R.U. are appointed from the H.Q. society.

"The I.A.R.U. is the recognised representative of the amateurs at the international level. Its representatives attend important I.T.U. conferences as observers. The I.A.R.U. played an effective role in the 1963 Space Communication Conference of the I.T.U. and successfully persuaded that conference to allot an exclusive band, i.e. 144 to 146MC, for amateur space communication experiments."

The writer goes on to explain that, because of financial difficulties, the I.A.R.U. has met only once, in Paris in 1950. He deplores the fact that these problems have made the I.A.R.U. less effective. Then he continues:

"The I.A.R.U. is divided into 3 regions,

***News and notes of Divisional and Club activities, submitted for inclusion in these columns, should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W.**

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more or less the same as the regions formed by the I.T.U. for frequency allocations. Region I comprises Europe and Africa. Region II; North, Central and South Americas, and Region III; Asia and Australia.

"Region I is fairly active and since 1953 has met five times. The next conference of this region is expected to be in 1966 when the discussion to represent for more frequency allocations for the Amateur Service is expected to be taken up. This region conducts regular VHF/UHF contests and are effectively participating in the International Quiet Sun Year.

"Region II was formed only in 1964 and is yet to get going. So far Region III has not been formed. Asia and Australia come under this region and the countries like Japan, Australia, New Zealand, Philipines have large numbers of amateurs. Australia has made a few attempts to form the Region III, in vain.

"Now there is a move to transfer the headquarters of the I.A.R.U. to Geneva where it can maintain better liaison with the I.T.U."

The remarks on Region III could provoke the thought that it may be the opportune ime for the W.I.A. to again attempt to orm a Region III organisation.

There is no doubt that the Divisional Councils and Federal Executive of the W.I.A. would welcome the views of members on such a project.

Of particular interest was the article entitled "International Telecommunication Union and Radio Amateurs." This was the ext of a talk given by Miss S. Lalitha VU2LA, leader of the YL group of the Amateur Radio Club, Bangalore. The talk was given over All India Radio on May 4, the eve of the Radio Amateurs of India I.T.U. Centenarv Celebrations.

The talk traced the history of the I.T.U. since its inception in 1865 and the part played by "Electrical Experimenters" prior o the first decade of this century, when 'Amateur Radio" began to be recognised as a hobby.

The part that amateurs have played which may not be well known, or forgotten, was recalled in these words:—

"Again, it was the radio amateurs who started broadcasting as part of their experiments. Even in our country, the early broadcasting was done by amateurs. The credit for the first broadcasting in India goes to the Madras Presidency Radio Club. n the year 1924, this club started broadcasting from the top of Rippon Buildings, Madras with the call sign '2GR.' This was followed by the Radio Club of Bengal n Calcutta and the Bombay Radio Club in Bombay.

"The B.B.C. in London was the first to ntroduce what we call the 'External Services Broadcasting.' But the B.B.C. was not the pioneer in this field. Actually, the B.B.C. took over this service from a radio amateur.

"British radio amateur Gerald Marcus was regularly transmitting from 1923, on a wave-length of 32.5 metres with his call sign '2MN.' These transmissions were heard n many parts of the world and they brought him encouraging letters.

"Encouraged by this response, Gerald Marcus obtained permission from the British Post Office to transmit programs to British Commonwealth Countries, entirely at his own expense, and called it the 'Empire Broadcasting Service.' His 1.5 kilowatt station put out entertainment programs several hours a week. Enormous success of these broadcasts to Commonwealth countries forced the B.B.C. to take over this service and run it as the 'External Services'."

My personal thanks goes to the editor and secretary of the Amateur Radio Club, Bangalore, G. V. Sulu VU2GV, for including me in the circulation of this Commemorative Issue.

For those who are wondering what the magazine name SIRAN means — South India Radio Amateurs Newsreel.

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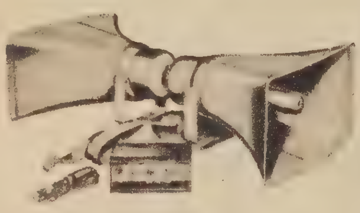

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WIRELESS INSTITUTE ACTIVITIES

Plans for the 1966 Federal Convention to be held in Brisbane are well in hand and it is anticipated that a number of important items will be included in the agenda.

Members are reminded that items which they consider should be included, should convey the details and their reasons to their divisional secretary without delay.

NEW SOUTH WALES DIVISION

The lecturer at the November general meeting of the New South Wales Division was Hans Ruckert, VK2AOU, who chose for his subject—"How I Built My SSB Transceiver."

Hans gave a very thorough description of the difficulties encountered in this extensive project and by the use of a good selection of slides was able to give an excellent description of the technical features of the unit.

Following a large number of questions, Tom O'Donnell, VK2OD, proposed a vote of thanks on behalf of the large audience present.

Two important motions were dealt with at the meeting. The first was on a subject that has been discussed for several years by Federal Council and the Councils of the Divisions: The new Federal Constitutio proposed by the Victorian Division.

The motion was: "That the draft memorandum and articles of association of th Wireless Institute of Australia be accepte by the New South Wales Division, subjec to the amendments recommended by th committee appointed to review the document." After several members spoke i favour of the motion, and a number c questions were answered by the chairma of the committee, Morrie Meyers, VK2VN the motion was carried, with only on dissension.

The second motion was: "That the div sional membership subscriptions be increase from March 1, 1966, to: Full membe 5 dollars (£2/10/). Associate members dollars 50 cents (£2/5/)." This was unan mously agreed to after some discussion an an explanation for the reasons.

DIVISIONAL PICNIC

Despite the threatening weather, abou 60 people, comprising members with the wives and families, attended a social picni at Parramatta Park on Sunday, Novemb 28.

The day was devoid of any radio act vities and was designed to give the wive and families a day out with the accen

JOHN MOYLE MEMORIAL FIELD DAY

The Federal Contest Committee of the Wireless Institute of Australia invites all Australian Amateur and Short Wave Listeners to participate in this Annual Contest, which is held to perpetuate the memory of John Moyle, whose efforts advanced the Amateur Radio Service.

There are two divisions of this Contest, one of 24 hours duration, and the other of six hours duration. The six-hour period has been included to encourage the operator who is unable to participate for the full 24-hour period.

Operators using 25 watts or less input to the final stage in each section will be considered for a certificate where activity warrants its issue.

It will be seen that the Federal Contest Committee has, in accordance with comments and suggestions received, made changes in the Rules. Tne F.C.C. hopes that the alterations will increase activity and Operators will again make an effort to participate in this contest.

DATE:—

From 0800 GMT February 12, to 0800 GMT February 13, 1966.

OBJECTS:—

The operators of Portable and Mobile Stations within all VK Call areas will endeavour to contact other Portable/Mobile and Fixed Stations in Australia and overseas Call Areas.

RULES:—

1. There are two divisions, one of six (6) hours, and one of twenty-four (24) hours duration. In each division, there are six sections:—

a. Portable/Mobile Transmitting, phone.
b. Portable/Mobile Transmitting, c.w.
c. Portable/Mobile Transmitting, open.
d. Portaole/Mobile Transmitting, Multipe operator. Open only.
e. Fixed Station Transmitting, working Portable/Mobile stations. Open.
f. Reception of Portable/Mobile Stations.

2. All Australian Amateurs are encouraged to take part, Portable/Mobile operators only will be eligible for certificates. Operators will be limited to their licensed power. This power shall be derived from a self-contained and fully portable source.

(a) Portable/Mobile Stations shall not be situated in any occupied dwelling or building. Portable/Mobile Stations may be moved from place to place during the contest.

No apparatus shall be set up on the site earlier than 24 hours prior to the contest. All amateur bands may be used, but no cross band operating is permitted.

Entrants in Section (d) for Multiple operator Stations can set up separate transmitters to work on different bands at the same time. All such units of a Multiple Operator Station must be located within an area that can be encompassed by a circle not greater than half a mile diameter.

For each transmitter of a multiple operator Station a separate log shall be kept with serial numbers starting from 001, and increasing by one for each successive contact. All logs of a Multiple Operator Station shall be submitted by the Operator under whose Call Sign the transmitters are working. No two transmitters of a Multiple operator station are permitted to operate on the same band at any time.

3. Amateurs may enter for any section in the Portable/Mobile Sections.

4. One contact per station for phone to phone, also one for c.w. to c.w. per band is permitted. Cross band operations will not be accepted for scoring purposes.

5. Entrants must operate within the terms of their licences and in particular observe the regulations with regard to portable operation.

6. Serial numbers consisting of RS or RST report plus three figures commencing with 001 and increasing by one for each successive contact shall be exchanged.

7. **SCORING·—**

(a) Portable/Mobile Stations:

For contacts with Portable/Mobile Stations ou side entrant's Call Area. 15 points.

For contacts with Portable/Mobile Stations with in entrant's Call Area. 10 points.

For contacts with Fixed Stations outside th entrant's Call Area. 5 points.

For contacts with Fixed Stations within th entrant's Call Area. 2 points.

(B) Fixed Stations:

For contacts with Portable/Mobile Stations ou side entrant's Call Area. 15 points.

For contacts with Portable/Mobile Stations with in entrant's Call Area. 10 points.

8. The following shall contstitute Call Area VK1, VK2, VK3, VK4, VK5, VK6, VK7, VK VK9, and VK0.

9. All logs shall be set out under the follow ing headings: Date/Time (G.M.T.), Band Emissio Call Sign, RST/No. Sent, RST/No. Receive Points Claimed, Contacts must be listed in numer cal order.

In addition, there shall be a front sheet show ing the following information:—

Name ....
Address ....
Section ....
Call Sign ....
Division ....
Section ....
Division .... (6 hour or 24 hou
Call sign of other operator(s) (if any) ...
....
Location of Portable/Mobile Station ....
From .... hours to .... hour

A brief description of equipment used, ban used and points claimed, followed by the decla ation:—

"I hereby certify that I have operated accordance with the rules and spirit of the co test."

Signed ....
Date ....

10. The right is reserved to disqualify a entrant who, during the Contest, has not observe the regulations and the rules of this Contes or who has consistently departed from the accept code of operating ethics.

11. The decision of the Federal Contest Ma ager of the Wireless Institute of Australia final and no disputes will be entered into.

12. Certificates will be awarded to the highe scorer of each section of each division. Addition certificates may be issued at the discretion the F.C.C.

13. Comments concerning the Contest, wi particular reference to:—Duration of contes Points scoring system, Rules of Contest, would appreciated by the F.C.M.

14. **RETURN OF LOGS.**

All entries must be postmarked not later tha February 28, 1966, and be clearly marked "Jo Moyle Memorial National Field Day Contes 1966," and addressed to:—

Federal Contest Manager, W.I.A.,
55 Moulden Avenue,
MT. YOKINE, WEST. AUST.

RECEIVING SECTION

15. This section is open to all Short Wa Listeners in VK Call Areas. The Rules shall the same as for the Transmitting Stations. Lo shall take the same form as for Transmitti Stations, but may omit the serial numbers r ceived.

Logs must show the Call Sign of the Statio heard, the serial number sent by it, and the Ca Sign of the Station being worked.

Scoring will be on the same basis as f Transmitting Stations. It will not be sufficient log a station calling CQ. A station may logged once only for phone and once for c.w. each band.

Awards:—Certificates will be awarded for th highest scorer in each Call Area.

on the family picnic atmosphere rather han the usual type of events that are held where amateurs congregate.

Quite a large number of tests of skill for the young and not so young were contested. The skill of the ladies in throwng the rolling pin or hitting the wicket was, although denied, probably due to practice in breaking up those QSOs that coincide with meal times.

It was also evident that when it came o getting noses in parallel to pass a ring from one to another, on toothpicks held between the teeth, the late teenage and young adult groups appeared to be in better form.

The wheelbarrow time trial event for he OMs was decided after several deadheats. At one stage it appeared that the train was going to be too great for the barrow when the steel wheel developed a lat.

All who attended voted that it was a most enjoyable day and suggested that another outing be held in February or early March.

Incidently, the prize list was extensive.

DIVISIONAL CONVENTION

The annual convention of the New South Wales Division will be held at VK2WI, he division's transmitting station, Quarry Road, Dural, on Sunday, January 30, 1966.

The president and council of the division expressed the hope that country members will be able to take advantage of the Australia Day holiday weekend to attend he function.

The proceedings will commence with the general monthly meeting of the division at the Wireless Institute Centre, 14 Atcheson Street, Crow's Nest, on Friday evening, January 28, commencing at 8 p.m. Included n the business for the evening will be he election of the Federal councillor for the ensuing year.

Consideration is being given by the council to the possibility of holding a convention dinner on the Saturday night f suitable arrangements can be made and sufficient number of members signify their ntention to attend. Members are requested o listen to the Sunday morning broadcast from VK2WI for further information.

Activities on Sunday the 30th will commence at 10 a.m. and a full day of mobile and pedestrian events are planned.

The first event will be a mobile scramble commencing at 9.30 a.m. for those travelling o Dural. All contests will be conducted on the 7MC or 144MC bands.

It is also planned to cater for the ladies with various competitions and a bus tour.

There will be several novel attractions, ncluding a hoop-la stall, ice-cream and soft drinks for the children and an 809 o be dehydrated by the OMs.

Demonstrations of home-constructed and commercial equipment as well as a disposals sale will add to the static attractions. Donations of a number of excellent prizes and technical literature have been made by a number of trade houses.

Interstate visitors are welcome and the grounds at Dural are available for parking caravans for those who may be travelling through Sydney during the weekend.

W.I.C.E.N.

At the November W.I.C.E.N. meeting, the technical committee submitted their report on frequencies to be used by the N.S.W. Division. The report, which was adopted, covers the VHF bands and there is no alteration to the existing frequencies in the 3.5MC and 7MC bands.

The frequencies are:—

Prime Mobile Frequency: 146MC, FM.
Prime Frequency: 53.950MC, FM.
Secondary Frequency: 53.952MC, FM.
AM Frequencies: 53.786MC, 53.826MC, 53.866M.C

Country stations who contemplate establishing six-metre nets are advised to contact the W.I.C.E.N. committee as to which are the best frequencies to use so as to avoid TVI and interference from other centres.

All communications on W.I.C.E.N. matters should be addressed to the secretary of the committee, Peter Campbell, 3 Earle Avenue, Ashfield, N.S.W.

HUNTER BRANCH

The November meeting of the Hunter Branch was attended by 35 members and visitors, who were addressed by Mr John Lake, of Mullard (Australia). Mr Lake chose the subject of "Semi-conductors" to address the meeting and members went away with a much better knowledge of these devices. A vote of thanks was moved by Bill Hall, VK2XT.

The next meeting of the Hunter Branch will be held on February 4, when there will be another lecture by a member of the Mullard staff. Details of this lecture will be given in the weekly news broadcast on Monday evenings at 7 p.m. from VK2AWX.

There has been a further increase in activity on the VHF bands since the introduction of two-metre mobile FM equipment made available through the W.I.C.E.N. group. Some other equipment has become available and several members now have equipment in their cars to operate on 146MC FM. It is proposed that a base station will be set up in Newcastle and this should mean good coverage in case of an emergency.

Two members received their limited licence callsigns during November. They are Fred Overliet, VK2ZFO, and Henry Schroeder, VK2ZGK. Both are members of the Westlakes Radio Club. They plan to be operational in the New Year on 144MC, but hope to convert their callsigns soon, to be able to operate on HF as well as VHF.

BLUE MOUNTAINS FIELD DAY

The Annual Field Day of the Blue Mountains Section of the New South Wales Division was held at the Swimming Pool Grounds, Lawson, on Sunday, November 21.

There was a good attendance of amateurs, accompanied by their families and friends, who spent the day with good weather in pleasant surroundings.

A bus tour of some of the beauty spots on the mountains was very popular with those not participating in the various radio events.

With the co-operation of the amateurs who entered in the field events, members of the Youth Radio Scheme and interested Boy Scouts were able to participate in one of the most interesting activities in amateur radio.

The results of the field events were:—
144MC Hidden Transmitter Hunt, on foot:
David MacNaughton, VK2ZVW, 1st.
Dick Norman, VK2ZCF, 2nd.
144MC Mobile Transmitter Hunt:
Dave Andrews, VK2AWZ, 1st.
Pierce Healy, VK2APQ, 2nd.
144MC Scramble:
Dick Norman, VK2ZCF (23 contacts), 1st.
Bob Lear, VK2ASZ (19 contacts), 2nd.
7MC Scramble;
Dave Andrews, VK2AWZ (23 contacts), 1st.
Trevor Huntley, VK2TM (8 contacts), 2nd.

There were also various lucky number prizes won by the ladies and amateurs present. The "Fox" for the 144MC mobile event was Dave Melbourne, VK2NK, who really went bush and lead the "Hounds" through some real rugged country, completely eluding nine of the 12 starters.

The section wishes to thank Mullard Aust. Pty. Ltd. for the donation of four transmitting valves and the N.S.W. Division for the prize of a miniature soldering iron. Individual amateurs who donated prizes for competition were: Arie Bles, VK2AVA; Derek Boyd, VK2NR; Dave Duff, VK2EO; and Bill Moore, VK2HZ.

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WITH THE CO-OPERATION OF OUR OVERSEAS ASSOCIATES OUR CRYSTAL MANUFACTURING METHODS ARE THE LATEST.

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Phone 86-6465

ESTABLISHED 1947

COAXIAL CABLES

UR67 50 ohm ⅜in diam. coaxial cable **1/6 yd,** or **25/-** per 27yds roll.

UR43 50 ohm 3/16in diam. coaxial cable **15/-** per 35ft roll.

UR71 72 ohm ¼in diam. coaxial cable **1/6 yd** or **£1** per 25yds roll.

51 OHM RG/8U 3/8 diam. BRAND NEW, 1/9 yd up to 500 yard lengths.

ALL ABOVE CABLES ARE IN AS NEW CONDITION.

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DUAL COMPLETE WITH METER IN METAL HAMMERTONE CASE

6 volt 4 amp 12 volt 4 amp	12 volt 6 amp 6 volt 6 amp
£7/17/6	**£10/17/6**

TRANSISTORISED AMPLIFIERS AND TUNERS

LAFAYETTE

PK-522 3 Transistor, Single Ended 50 mW Output	**£2/17/6**
PK-543 4 Transistor, Push Pull, 100 mW Output	**£3/15/-**
PK-544 5 Transistor, Push Pull, 250 mW Output	**£5/17/6**
PK-801 4 Transistor, Push Pull, 1 Watt Output	**£5/17/6**
PK-633 3 Transistor, 1 Diode, Broadcast AM Tuner	**£6/15/-**

MICROPHONES

CRYSTAL	
Piezo Lapel Type with Plug	**12/6**
CM20 Hand Type with Plug	**27/6**
X43 Stand Type with Plug	**37/6**
BM3 Pencil Type 100-8000 c/s. with On-Off Switch, 6ft cable	**50/-**
BM3 Desk Stand to suit above	**21/-**
DYNAMIC	
Foster DF2 Hand Type 50K	**50/6**
Foster DF2 Hand Type 50 ohm	**45/-**
Foster DF3 Pencil Type 50K	**90/-**
Foster DF3 Pencil Type 50 ohm	**87/6**
Piezo X29 Desk Type with stand, low imp.	**82/6**

SPEAKER BOXES

Plastic Speaker Box with 4in Speaker and Wire	**55/-**
Wooden Speaker Box with 6in x 4in Speaker and wire	**65/-**

GRID DIP OSCILLATORS

Lafayette TE-18 G.D.O. 8 Bands, Plug in Coils, 360 Kc-220 M/C, 240 volt	**£19/15/-**
Leader LDM-810 G.D.O. 2-250 M/C 6 Band, Plug-in Coils, 230 Volt	**£22/5/-**

CHASSIS PUNCH SETS

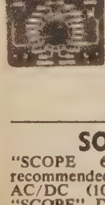
Hozan K-83 Sizes 16, 18, 21, 25 and 30 mm., Complete with Taper Reamer in wooden storage box	**70/-**

TAPERED REAMERS

Hozan Tapered Reamer 3mm.-14mm.	**11/-**

SAKURA CIRCUIT TESTER

Model TR6S



Sensitivity: DC 20,000 ohms/volt, AC 10,000 ohms/volt. Ranges — DC volts: 6, 30, 120, 600, 1,200v; AC volts: 6, 30, 120, 600, 1,200v. DC current; 60 uA., 6 mA., 60 mA., 600 mA. Resistance: 10K, 100K, 1M, 10M ohms. Capacitance: 0.001-2 uF., 0.0001-0.01 uF. Inductance: 30-3,000H. Decibels: Minus 20 to plus 17 db. (0db.—0.775v.—600 ohms). Dimensions: 4⅛in x 6¼in x 2⅜in. Weight: 1.3lb.

Price £8/10/-

SOLDERING IRONS

"SCOPE 6 Second Soldering Iron, recommended working voltage: 4 volts, AC/DC (100W)	**45/**
"SCOPE" De-Luxe Model, as above, with stainless Steel Barrel, in Plastic Pouch	**50/**
"MINISCOPE" Soldering Iron (uses standard Transformer), in Plastic Pouch	**45/**
TRANSFORMER Suitable for Scope or Birko, Soldering Irons, 230 volt to 3.3 volt	**50/**
"BIRKO" 6 Second, Soldering Iron 4 to 6 Volt AC/DC, in Plastic Pouch	**39/6**
Or with Transformer	**£4/4/**

SPEAKERS

WELL KNOWN MAKE, BRAND NEW, BANKRUPT STOCK.

SIZE	V.C.	PRICE
2in	15 OHM	**30/-**
3in	15-3.5	**32/6**
4in	15-3.5	**37/6**
5in	15-3.5	**40/-**
6in	15-3.5	**45/-**
5in x 7in	15-3.5	**47/6**
8in	15-3.5	**52/6**
9in x 6in	15-3.5	**55/-**
12in	15-3.5	**82/6**

TWIN CONE SPEAKERS

5in Twin Cone 4W 15 OHM	**45/-**
8in Twin Cone 10W 15 OHM	**77/6**
12in Twin Cone 10W 15 OHM	**100/-**

CORDOVER SOLID STATE MODULES

20 different types, P.A. amplifier, electronic siren, burglar alarm, intercom. module, guitar, amplifier module, phonograph amplifier module, wireless microphone module, and many others, Dimensions: 1⅜" x 1⅝" x 1"

Price approx. £4 per unit

Send stamped, addressed envelope for more details

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CENTRAL CT500 Multimeter 20,000 opc D.C.,	**£6/15/-**
CENTRAL CT330 Multimeter 20,000 opv DC	**£8**
SANSEI SE550 Multimeters 100,000 opv D.C.,	**£12**
Multimeter Probes	**6/**
200H Movement	**57/6**
Meter Rectifiers	**10/**

CRYSTALS

Crystals in FT243 Holders. As New EX SCR536/BC611 Walkie-Talkies.

4495 Kc.	5660 Kc.
4852.5 Kc.	5780 Kc.
5327 Kc.	5920 Kc.
5385 Kc.	6235 Kc.
5397 Kc.	6375 Kc.

SPECIAL PRICE TO CLEAR

7/6 each or 3 for £1
75c each or 3 for $2

CITIZENS BAND CRYSTALS

Miniature HC6/U ½" pin spacing
27.240 Megacycle 27/6 each.
26.785 Megacycle 27/6 each.
HC6/U Crystal Sockets 2/9
FT243 Crystal Sockets 2/9

CLIENTS NOTE, THE ABOVE FREQUENCIES ONLY AVAILABLE AT THE MOMENT.

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WELL-KNOWN MAKES BRAND NEW IN CARTONS

150ft on 3in reel (Acetate Base)	**6/**
225ft on 3in reel (Acetate Base)	**7/6**
300ft on 3in reel (Tensilised Mylar)	**12/**
500ft on 3in reel (Tensilised Mylar)	**16/**
600ft on 3¼in reel (Tensilised Mylar)	**17/6**
900ft on 5in reel (Acetate Base)	**19/6**
900ft on 5in reel (Mylar Base)	**22/6**
1200ft on 5in reel (Mylar Base)	**35/**
1800ft on 5in reel (Tensilised Mylar)	**52/6**
1200ft on 5¾in reel (Mylar Base)	**35/**
1800ft on 5¾in reel (Tensilised Mylar)	**52/6**
1200ft on 7in reel (Acetate Base)	**25/**
1200ft on 7in reel (Mylar Base)	**30/**
1800ft on 7in reel (Acetate Base)	**35/**
1800ft on 7in reel (Mylar Base)	**39/6**
2000ft on 7in reel (Mylar Base)	**42/6**
2400ft on 7in reel (Mylar Base)	**52/6**
3000ft on 7in reel (Tensilised Mylar)	**75/**
3600ft on 7in reel (Tensilised Mylar)	**92/6**

EMPTY TAPE REELS

3in	2/6	5in	3/
3¼in	3/3	5¾in	5/
4in	3/6	7in	5/

OR in Plastic Storage Box

5in	8/	7in	12/

TAPE Splicers. Complete with Splicinf Tape and instructions 5/

LOG BOOKS, 5/6 each, postage 1/-.

COAXIAL CONNECTORS

AMERICAN TYPE

PL259 Coaxial Plug	**9/6**
4087-1 Coaxial Plug (PL259 PTFE)	**14/6**
SO239 Coaxial Socket (Suit PL259)	**9/**
4802-1 Coaxial Socket (PTFE)	**14/8**
C32-14 Coaxial Dble. ended female Cable Joiner (PTFE)	**17/6**
UG175U Adaptor for PL259 to suit ¼in Cable.	**2/9**
C32-17 Coaxial "T" Piece suit PL1259	**23/3**
BNC Series	
UG 88 C/U Coaxial Plug (PTFE)	**15/9**
UG290/U Coaxial Socket (PTFE)	**12/6**
Belling Lee Type	
Coaxial Plug (Suit ¼in Cable)	**4/**
Coaxial Socket	**3/6**
Coaxial Socket (flush Mount)	**3/6**
Coaxial Cable Joiner (female)	**4/**

WANTED TO BUY

COMMUNICATION RECEIVERS, TRANSMITTERS, TEST EQUIPMENT, AMPLIFIERS, TRANSISTOR RADIOS, TAPE RECORDERS, SPEAKERS, TRANSFORMERS, ETC.

TRANSISTORS and DIODES

OC44	**16/**	OA79	**4/6**
OC45	**16/**	OA80	**3/6**
OC70	**12/6**	OA90	**3/6**
OC71 .. 7/6	**3 at £1**	OA91	**3/6**
OC72	**16/**	OA210/1N1763	**8/6**
OC74	**12/6**	OA211/S10AR2	**17/6**
OC75	**12/6**	**ZENER**	
OC170	**16/**	OAZ224/BZZ16	**27/6**
OC171	**16/**	OAZ222/BZZ14	**27/6**

ADEL NIBBLING TOOL

Designed to cut round or square holes in sheet metal, with instructions.

75/-

WALKIE TALKIES

9 Transistor 100 mW output Citizens Band, 27.240 Mc. Fully Transistorised Walkie Talkies. Individual Speaker and Microphone. Dimensions, 7⅛in x 2⅝in x 2in. Complete with Batteries, Earphone and Leather carrying case.

£39/10/-

Inc. tax, plus freight.

CLIENTS PLEASE NOTE

ALL PRICES QUOTED IN THIS ADVERTISEMENT INCLUDE SALES TAX WHERE APPLICABLE. PLEASE ADD POSTAGE WHEN ORDERING. SORRY, NO C.O.D.

ROTARY SWITCHES

3 pole 3 position	**10/**	2 pole 6 position	**10/**
4 pole 3 position	**10/**	1 pole 12 position	**10/**

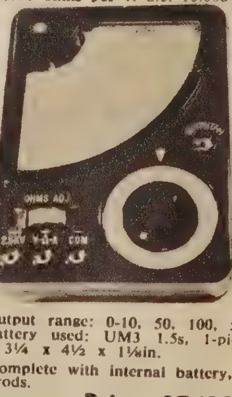
HI FIRE TRANSISTORISED IGNITION SYSTEM

6 OR 12 VOLT

POSITIVE EARTH	**£26**
NEGATIVE EARTH	**£25**

MULTIMETER Model 200H

20,000 ohms per v. d.c. 10,000 ohms per v. a.c.



Specifications:
DC volts: 0-5, 25, 50, 250, 500, 2,500.
AC volts: 0-10, 50, 100, 500, 1,000.
DC current: 0-50 uA.; 25, 250 mA.
Resistance: 0-60 K ohms; 0-6 meg.
Capacity: 0.01-0.3 uF; (at AC 5v); 0.0001 - 0.01 uF. (at AC 250v).
Decibel: Minus 20 db plus 22 db.

Output range: 0-10, 50, 100, 500, 1,000. Battery used: UM3 1.5s, 1-piece. Dimensions: 3¼ x 4½ x 1⅛in.

Complete with internal battery, testing-leads and prods.

Price £5/12/6 inc. tax.

VHF GROUP

The activities of the VHF Group during the latter part of 1965 were devoted to preparing for the New Year Field Day, and by now there are a number of long-haul contacts logged.

From mid-November the six-metre band activity increased when openings started to take place to all States and New Zealand. In Sydney, on Friday, November 28, a blanket opening occurred and stations in all States and New Zealand could be heard working each other.

The beacon station of the West Australian VHF Group, VK6VF, was also heard. At 1650 EST on November 28, a five-minute opening to New Zealand took place on 144MC enabling VK2ZEL to exchange Readable 5 Strength 8 signal reports with ZL3JE. Other stations were heard calling, but no contacts were reported. A cross-band contact between VK2ZVL on 144MC SSB and ZL3RK on 52MC AM was made.

Both Channel 5A in New South Wales and Channel 2 in New Zealand provide signals which indicate possible two and six-metre openings across the Tasman.

NORTH-WEST ZONE CONVENTION

The North-West Zone Convention, the first to be held in that section of the New South Wales Division, will take place at Tamworth over the Australia Day holiday weekend.

The venue will be at the Presbyterian Boys' Hostel, where accommodation — for men only — has been arranged at a very reasonable charge.

Activities will commence on Saturday afternoon with a tour of inspection of the local TV station, NEN 9, studios. This will be followed on Saturday evening by a buffet supper and a 144MC transmitter hunt.

On the Sunday there will be a Mobile or Portable 7MC Scramble in the morning followed by:

7MC Hidden Transmitter Hunt.
144MC Hidden Transmitter Hunts.
144MC Pedestrian events.
Auction sale of radio equipment.
Ladies' and Gents' quizzes.
Special event for ladies.

There will be free ice-cream and soft drinks for the children and morning and afternoon teas will be served.

Full details on accommodation and other information can be obtained by writing to the Zone Officer, Max Francis, Hill Street, Scone, N.S.W.

CENTRAL COAST SECTION

Discussion has taken place during several recent meetings on the pros and cons of a suggestion that the Central Coast Section should become a branch of the New South Wales Division. The subject was finalised at the November meeting when members signified their agreement with the proposal and the matter will be passed to the Divisional Council for ratification.

The date for the Annual Field Day at Gosford has been set for February 27. The location will be at the Gosford Racecourse, as in previous years. The full program is in course of preparation and will be included in the next issue of the notes. Plans are being made for the usual events, as well as a boat trip on the Brisbane Waters and a bus tour of the local beauty spots.

The Central Coast is widely known for its scenic attractions and is well worth the trip to Gosford. All events will be included in the registration fee.

Amateurs holidaying in the area and interstate visitors passing through are invited to make their rendezvous Gosford on February 27.

CANBERRA RADIO SOCIETY

The annual meeting of the Canberra Radio Society was held on Friday evening, November 19. The following officers were elected for the forthcoming year:

President: Ken Mattei, VK1KM.
Vice-President: Les Pitts, VK1PI.
Secretary: John Weatherley, VK1QL.
Treasurer: Bert Forsyth, Assoc.

It was also decided to hold the Annual Convention at Easter. Details will be published later.

VICTORIA

The 1966 Victorian Division State Convention will be held at Ararat in the Western Zone on the Anzac holiday weekend, April 23-25. Full details will be available later.

Twelve stations participated in the VHF Field Day held on November 21. Several high scores were recorded, among them was that of VK3ZCG with 2,078 points. It was reported that scores could have been very high had the six-metre opening to VK4 lasted longer.

VK3ZCG operated from a location 2,470 feet high and used an eight-element phased array on 144MC fed from a three-unit FM "Carphone" with an output of 26 watts. Also used was an AM transmitter running 7 watts. The receiver was a wide band two-metre single conversion superhet.

W.I.A. YOUTH RADIO SCHEME

With the close of the school year and the attendant examinations, there was a tapering off of news from the various clubs. However, the Federal Supervisor of the scheme, Rex Black, VK2YA, reports that a number of YRS Club members have gained cadetships or apprenticeships in communication and electronic industries. Several have taken up careers in the Navy and R.A.A.F.

Parents' and citizens' organisations who may be interested in encouraging students to take up this well worthwhile hobby may obtain full details on how to start a club, as well as information on the various certificates issued to successful students, by writing to Rex Black, Federal Supervisor, Youth Radio Scheme, 5 Bennett Street, Kingsgrove, N.S.W.

WESTLAKES RADIO CLUB

Ray Carpenter, Jan Miller, Michael Kane, Robert Bennett, Neil Kilgour, David Fraser, all members of the Westlakes Radio Club, have received their Elementary Certificates. They all intend studying hard for the Junior Certificate.

The project most favoured by the group is the three-transistor radio receiver which has proved to be a highly successful design.

All the boys from the club who presented "Multiflash" projects in the recent AWV competition were highly commended and were awarded subscriptions to the magazine "Radiotronics."

The club featured prominently in the 1965 edition of "Interadio," the magazine of the International Amateur Radio Club, with headquarters in Geneva.

The article was a double page spread on amateur radio in Australia and featured a large photo of the boys at the Morse trainer.

CHRISTMAS ISLAND

It is very pleasing to receive what must be one of the most unique publications in the world—"The Christmas Island Bulletin."

This is the monthly newspaper produced to give the inhabitants condensed details of world events as well as local news and the activities of various clubs on this remote island in the Indian Ocean.

One of the most active and well represented clubs on the island is the Christmas Island Amateur Radio Club, which operates under the call sign of VK9XI. Don Reed, VK9DR, conducts the advanced radio theory class at the club, while Ron Ashley and Allan Watson conduct a class which is now advancing into radio theory proper.

A third class is conducted by Chung Yew Meng in the Chinese language, and deals with radio receiving theory and practical radio repairs.

At a recent 144MC hidden transmitter hunt held on a Sunday afternoon, over 50 were present at the "Fox Hole" for the barbecue at the conclusion of the hunt.

Club members take a very active part in contests such as the Remembrance Day contest, and the VK-ZL-Oceania DX Contest. They were also active in the Jamboree-on-the-Air.

The club's log book contains many fine DX contacts and the QSL Bureau is managed by Alan Bradley. The cards that adorn the walls of the clubroom are a tribute to the interest members have in their club.

The club is a registered member of the Youth Radio Scheme and takes a keen interest in the activities of Australian school clubs.

GHOST PROJECT

The Commonwealth Bureau of Meterology have issued an invitation to Australian amateur operators to take part in a joint United States-New Zealand Global Horizontal Sounding Techniques (GHOST) project.

It is planned to launch a series of 100 balloons from Christchurch, New Zealand, over the next six months. These balloons are designed to float at various levels from about 20,000 to 80,000 feet altitude and emit a one watt signal around 15.025 megacycles, modulated to indicate sun angle.

The signal emitted is a repeated morse character and the frequency of repetition indicates the sun angle. The expected reception range is up to 4,000 miles. One in every five balloons will transmit four characters indicating four meterological parameters. As the power is obtained from solar cells, transmissions will be during the balloon's daylight hours only.

Transmissions will be monitored in New Zealand, American Samoa, Tahiti, Chile, Argentina, Mauritius and Australia.

The exercise is basically a navigational problem and therefore as well as accurate timing of the rate of reception of signals it is essential that the absolute time be recorded accurately.

Highly directive aerials are not recommended because of the probable spread of the balloons. A simple aerial, for example a vertical or di-pole, is expected to be adequate.

It is expected that the received signal will be at or below the ambient noise, therefore a good communication receiver will be necessary. A stop watch having a ten second sweep time will also be required.

Advance information on launchings and report forms on which balloon information may be recorded will be distributed to participants on request.

Further information and forms can be obtained from the Director of Meteorology, P.O. Box 1289K, Melbourne, Victoria (attention Mr Henderson).

OSCAR PROJECT

Information at the time these notes were being compiled was that Oscar IV would be launched during the first week in December. If this target was achieved, the fourth orbiting satellite carrying amateur radio will now be doing a 18,200 nautical mile orbit of the earth.

The satellite will be completely solar powered and will have an expected life of about one year.

On October 12, 1965 (Columbus Day), Project Oscar was honoured by receiving the Christopher Columbus Award, presented by the Institute of International Communications of Genoa, Italy. The award consists of a plaque and a gold medal, attesting to the efforts of Project Oscar in promoting peaceful international communication among radio amateurs worldwide. At hand to receive this award were Oscar members W6SAI and W6UF.

Roy Hart, VK2HO, who recently relinquished the position of Oscar Co-ordinator for Australia, received a letter from the Oscar Project president, Bill Orr, W6SAI, thanking him for his work on behalf of the project team. Roy has devoted a lot of time and effort during the past years in keeping the Australian amateurs informed on the progress of the three Oscar projects which, no doubt, also merits the thanks of those who, by use of the information, were able to follow the project.

A. AMPLIFICATION
C. COMMUNICATION
E. ELECTRONICS

PHONE 51-3845

RADIO

636 KING STREET, NEWTOWN—51-7008

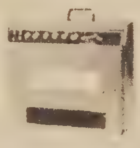
136 VICTORIA ROAD, MARRICKVILLE — 51-3845

PLAYMASTER 2
STEREO AMPLIFIERS

Push-Pull. 8 Watt per Channel Bass and Treble boost and Cut. Wired and Tested.

£31

Buyers please note: Due to component and production cost increases we regret the price of P.A. Amplifiers, Guitar Amps. and Stereo Amps. will be increased in the near future.



GUITAR
AMPLIFIERS

10-Watt. Two Channel, with Twin Cone Speaker. £25/15/-.

14-Watt. 4 Inputs. Bass and Treble Boost. 2 Twin Cone Speakers. £29/15/-.

17-Watt. Four-Channel. Bass and Treble Boost. Two Twin Cone Speakers. £36/17/6.

35 WATT

4-Channel. Bass and Treble Boost. 4 Twin-Cone Speakers .. £52/10/-
60-Watt. 2 Unit
4-12in Auditorium Speakers.

£85/17/6

Vibrato with foot control and 2 pre-set controls for frequency and intensity. £5/5/- extra on above models.

14 plus 14 WATT

With Reverberation. May be used as 28 Watt or as 14 Watt plus 14 Watt Reverb. 2 9 x 6 Woofer Speakers. 2 9 x 6 Twin-Cone Speakers. 4 Channels. Bass and Treble Boost. Foot Vibrato Control included.

£81/15/-

SLAP BASS OR BASS GUITAR 40 WATT AMPLIFIER

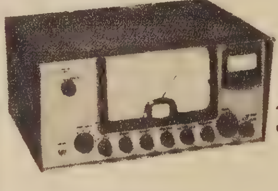
4 Input Channels. Bass and Treble Boost. 2 12in Radial Beam Speakers. Perfect reproduction on 20 cycles.

£72/17/6

PIGGY BACK
GUITAR AMPLIFIER

30 Watt	£39 17 6
45 Watt	£49 17 6
60 Watt	£59 17 6

4 Inputs. Bass and Treble Boost. Vibrato if required. £5/5/ extra.



£72/10/-

1965
COMMUNICATIONS 8

R. TV and H., January

This outstanding receiver for Ham or General use.

Wired — Tested
Guaranteed

With mechanical filter.
£20 Extra

TRANSISTOR CAR RADIO

Push-button operation. High sensitivity. Tailored to fit most modern cars. 6v or 12v operation — state voltage. Polarity and speaker size.

£29 Complete

NEW RECORDING TAPE

5¾" 850ft	1	2	6
3in Mylar L.P. 300ft		10	6
5¾in Mylar L.P. 1150ft ..	1	7	6
5¾in Mylar D.P. 1650ft ..	1	17	6
7in P.V.C. 1200ft	1	5	0
7in Mylar L.P. 1800ft ..	1	17	6
7in Mylar D.P. 2400ft	2	15	0
10½in Mylar L.P. 3500ft ..	4	15	0

Post 2/6 per Spool.

P.A. SPEAKERS

8 WATT
8in Units in Waterproof Projection Horns.
15 Ohm Voice Coils.

£6/15/-

In Double Ended Flares.
Duolateral Coverage.

£7/5/-

Line Output Transformers to suit, 17/6 extra.

P.A. SPEAKER DRIVER UNITS

American Rating. 30 Watts. Voice Coil 16 ohm.

£10/15/-

15 Watt Rating.

£7/17/6

REFLEX HORNS TO SUIT.

£10/15/-

WEEKEND — HOLIDAY — EVENING DEMONSTRATIONS AT COLLAROY

PHONE XW5956 FOR APPOINTMENT TO TEST STEREO GUITAR AMPLIFIERS AND TELEVISION.

BATTERY CHARGER

240 Volt A.C. Operation

3 Rate 6V, 12V TRICKLE CHARGE

Trickle Charge Position suits all Batteries. 2V to 12V at rate of 200 to 500 M.A.

STANDARD

2 amp. 6V. 12V. TRC	£5/15/-
3 amp. 6V. 12V. TRC	£6/12/6
4 amp. 6V. 12V. TRC	£7/12/6
5 amp. 6V. 12V	£7/19/6

Post., N.S.W. 7/6, Interstate 12/6.

DE LUXE

1½ amp., 6v-12v	£4/17/6
3 amp.	£8/7/6
4 amp.	£9/17/6
6 amp.	£10/17/6
10 amp.	£13/17/6

Rail or Air Freight on.

Cabinet only £5/15/.
Cross-over unit £1/12/6.

PLAYMASTER
BOOK SHELF UNIT

To R, TV & H specifications. Mountain Ash, Maple or Walnut finish.

Complete £14/5/

Also to suit, 8 W.R. and new Magnavox HF5SIC Tweeter.

£14/5/-

REVERBERATION UNITS

Latest design to suit organs, stereo, guitar, any hi-fi equipment.

£2-17-6 each

Post. 3/6.

ELEGA REVERB. SPEAKERS

Automatic addition of reverberation to any existing amplifier. Handles 12 watts.

£12-15-0

CO-AXIAL SPEAKERS

C.S-30. 12"

V.C. 16 ohm. Cross over 3,000 cycle. Frequency range 30 to 20,000 cycles. Rated 20 watts.

£13/19/6

C.S-20. 8"

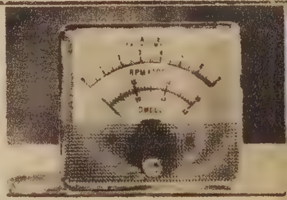
V.C. 16 ohm. Cross over. 3,000 cycle. Frequency Range 40 to 20,000 cycles. Rated 8 watts.

£7/19/6

HORN TWEETER
CT-3

2,000-20,000 Response.
20 Watts Power.
Sensitivity 110 dbw.
Weight 1¾lb.

£4-9-6



MULLARD-A.C.E. TACHOMETER

Wired and tested.
£10/7/6

"Electronics Australia", July, August issue. State max. revs., voltage, polarity cylinders.

METER ONLY
£3-7-6

INCLUDING DWELL. ANGLE FACILITY.
£11/12/6

Post.: N.S.W., 5/; Interstate, 7/6.

A. AMPLIFICATION
C. COMMUNICATION
E. ELECTRONICS

PHONE 51-3845

RADIO

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4-TRACK. 3-SPEED.
3 HEADS.

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Latest ½ Track. Hi Fi.

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Takes 7in spool.
3 speeds 1⅞, 3¾, 7½ i.p.s.
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Provide infinitely variable AC voltage.

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WIRED AND TESTED. **£42**

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Simple installation.
38 K.V. output.
Complete. Tested.
Negative earth.

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27.240 Meg Fonet 102B
10 Transistor Transceivers.
Hi-Power. 240 MW.
Range to 10 miles.

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1 watt. 15 transistor, with squelch provision for two channels. Range to 60 miles under ideal conditions.

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2 Station Transistorised

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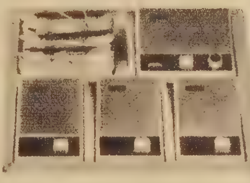

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New 10-channel Tuners.

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240V A.C. Mono	£5	15	0
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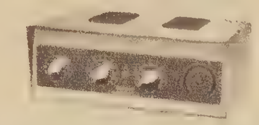

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15 WATTS OUTPUT.

Multimach Ferguson O.P. transformer input for crystal mike and pick-up with electronic mixing. P.P. EL.84 output. £17/15/-

30 Watt. As above EL34 P.P. £25/15/-

40 Watt. As above EL34 P.P. £37/15/-

60 Watt. As above EL34 P.P. £42/15/-

100 Watt. As above KT88 P.P. £63/17/6

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MULLARD HI-FI RANGE.

5/10 with pre amp base and treble boost. Ultra Linear output £21/15/-

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6 valve 6v plus 240v-10 watt £27/15/-

7 Valve 12v plus 240v-12 watt £29/17/6

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TRANSISTOR P.A. AMPLIFIER C.A.-512

12VDC Operation
Output 20 watts
Current consumption at max. output. 2.2 amps.
Input. High imp. mic. Also 600 ohms and tape.
Independent gain controls.
Output: Imp. 4-8-16 ohms.
Freq. Response:
200 cps—6000 cps
Dimensions 2in x 6¼in x 8½in.
Complete with instruction book with circuit. All plugs.

PRICE £28/15/-

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DM -391 Hi-Imp	£1	15	0
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DM -305. 600 ohms or Hi-Imp. Suitable stand mounting ..	£4	17	6
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CM -10 Crystal Hi-Imp Suit. stand mount.	£2	10	0

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Ceramic Units. Sapphire Styli	£3	10	0
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15 ohm. Twin Cone

8in	3	10	0
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12in Heavy Duty 20 watt	£7/15/		

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5 Watt 8 ohm	7	5	0
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N.B.: As these are American ratings, divide the wattage by 2.

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Fully machined and balanced. Heavyweight turntable. Ceramic cartridge.

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With padded earpieces
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Frequency Response 25—17000 cps.
Nominal Power 1 watt.
V.C. Imp. 8 ohms each channel.

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4-Speed Players.
6V. D.C. OPERATION.
MONAURAL CRYSTAL HEAD

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New lightweight, fully adjustable units

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As above with buzzer.
Complete Morse practice set.

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K 20 CT330 **K 20** CT500

220S 4000 O.P.V.

D.C. Volts 5, 25, 125, 500, 2500. A.C. Volts 10, 50, 250, 1000. Current. 250uA, 250mA. Resistance 0-10K, 0.1 Meg.

£3/19/6 Post 5/-

C.T.330 20K.OPV

D.C. Volts, .6, 6, 30, 120, 600, 1200 3000, 6000 A.C. Volts, 6, 30, 120, 600, 1200. D.C. Current, .06-6, 60. 600mA. Resistance. 6K, 600K, 6meg. 60meg. D.B. minus 20 to plus 62. 5 Ranges. Specially suitable for transistor use. **£7/19/6** Post 5/.

C.T.500 20K.OPV

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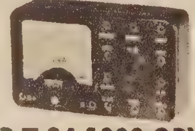
S.E.550 100K.OPV

D.C. Volts, .5, 2.5, 10, 50, 250, 500, 1000. A.C. Volts, 2.5, 10, 50, 250 1000 D.C. Current. 10uA, 2.5, 25. 250mA, 10 amps. Resistance. 2K 200K, 2M, 20M. D.B. minus 20 to plus 62.

£10/7/6 Post, 7/6.



P.T.34 1000.OPV

D.C. Volts. 0, 10 50, 250, 500, 1,000.
A.C. Volts. 0, 10, 50, 250, 500, 1,000.
M.A. 1-100-500 RESISTANCE.

£2/12/6 Post 5/.

200H. 20K.OPV

D.C. Volts, 5, 25, 50, 250, 500, 2500. A.C. Volts, 10, 50, 100, 500, 1000. D.C. Current. 50uA, 2.5, 250mA. Resistance. 6K, 600K. Capacitance. 2 D.B. Ranges.

£5/5/- Post, 5/.

ALL PRICES NET. INC. S./TAX.

V.T.V.M.

27 Ranges A.C. Powered.
D.C.V. 0, 1.5, 5, 15, 50, 150, 500, 1,500.
A.C.V. 0, 1.5, 5, 15, 50, 150, 500, 1,500 R.M.S.
A.C.V. P. to P. 0, 1.4, 4, 14, 40, 140, 400, 1,400, 4,000.
Resistance 1 ohm to 1,000 megohm.
D.B. — 10 D.B. to + 65 D.B.

£21/5/-

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H.V. Probe to 30 KV, £4/2/6.
T.M.K. Units, £26/15/-

TEST EQUIPMENT

WIDE BAND OSCILLOSCOPE

5 Meg. Bandwidth. Push-pull vertical and horizontal Amplifiers. 8 position, high sensitivity vertical Amplifier, Frequency Compensated on all positions. Calibrated .02 to 600 volt. Hard-time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

3-inch £49/17/6; 5-inch £55/15/-

STEREO TAPE AMPLIFIER

Tape. Amplifier. Complete. Stereo Tape. Amplifier. 5 watts per channel.

KIT SET £80 WIRED & TESTED £90

To suit Brenel, BSR, Collaro or Truvox 3-head decks. Decks available if required.

12 watts per channel. Equal to 101 amplifier. Wired and tested. Only **£100**

G.D.O. UNITS

Leader. 810. 6-Band. 2 Meg. to 260 Meg. Nuvistorised. 240 V.A.C. Operation. Modulated. Calibration Accuracy 2 per cent.

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T.E. 18 Lafayette. 8 Bands. 360 K.C. to 260 Megs. 240 V.A.C. operation.

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LEADER SWEEP & MARKER GENERATOR

TV and F.M. 2 to 270 Megs. 5.5 Meg. Crystal for TV sound. Sweep width to 12 Megs. Model 531.

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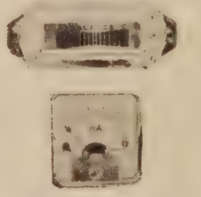

EDGE TYPE

1 mA. Sealed. S. Meter. Stereo Balance. Tuning. **£1/5/-**

2" 3" 4" PLASTIC COVERED PANEL UNITS

Latest P series ¾in Barrel 50 mmA. 200 mmA. 1mA. 10 mA 500mA, 1 Amp, 10 Amp. 15V. 500V. **From £1/10/-**

T.E. 20 RF SIGNAL GENERATOR

Freq. 120KC—260MCS in 6 bands.
Output (RF)—High 100,000uV max.
Low 100uV max.
Output (Audio)—400 cps approx. 8V.
Modulation — 400 cps internal.
Operation — 240V AC.
Dimensions 7in x 10½in x 5½in.
Weight — 9lb.
Complete with Instruction Book circuit.

£13/5/-

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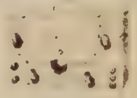

LEADER SIGNAL GENERATOR LSG 11

240v A.C. Powered.
6 Band, 120 Kc to 390 Megs.
Provision for Crystal.
An Ideal TV Marker Generator.

£14/15/-

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Transistorised. Fountain Pen sized Unit for Signal Tracer in Radio, TV and Amplifier Service.

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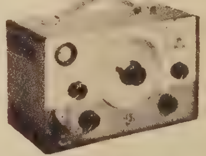

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Bridge and Analyser
Capacity 20 pfd to 2,000 mfd.
Resistance 2 ohm to 200 megs.
Also tests power, factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs. at 600V.
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Sine and Square Wave.
20 Cycles to 200 KC. 4 Bands.
Frequency response plus/minus 1.5 D.B.
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Output impedance 5,000 ohm.
Output volts, 0 to 7.

£22/2/6

VALVE TESTER

Tests all valves, diodes, rectifiers, checking filaments, shorts. Merit on direct reading. Good-bad meter. Complete with tube chart.

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LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

Higher Power, More Relays for 1966

The trend for international short wave radio stations for the new year is for still higher power, and the use of relay bases nearer the target area, according to information to hand.

THE Deutche Welle relay at Kigali, Rwanda, Central Africa, was officially opened recently, and the station has since announced that it will augment the present 250KW transmitter by two more units of the same output. The Deutche Welle authorities in Cologne, Germany, also announce they plan to build a relay station on the island of Baonire, in Netherland Antillies, the site of the very successful new Trans World Radio station, which also relays the Radio Nederlands programs. The new German relay at Baonire will be the second of a series of four. The Baonire relay will cover the American continent, as Kigali covers Africa, and other relay bases are planned for South West Europe and Asia. The Voice of America first initiated the idea of strong relay bases near the target area, to enable strong reliable signals to be rebroadcast throughout the year.

The tremendous increase in the transmitting hours of international shortwave stations is shown in a recent report which gives the figures of transmitting hours per week of the major short wave services. The Soviet Union has 1341 hours a week; other East European countries, 1133 hours; China, 897; Voice of America, 870; BBC London, 630; Egyptian Radio, 440; and Radio Nederlands, 200 hours a week, according to DX Juke Box on Radio Nederlands.

The increase in power of transmitters continues. Radio South Africa has its first 250KW now in operation. The Austrian Radio in Vienna is to use new 100KW transmitters from September and the new transmitter building is nearing completion. The Swiss PTT opened a new 250KW transmitter to relay the three languages to the European listener: these transmitters are omnidirectional and operate on 6165 and 9535KC.

According to sources in Paris, Radio Peking plans to order two 350KW transmitters, and this will give them the strongest shortwave transmitter in the world, as, used in parallel, they will have an output of 700KW. This is higher than the present strongest transmitters, which are operated by the Voice of America with 500KW, though the VOA has three medium wave units with a power of a million watts.

The Thailand Ministry of Education has approved in principle the building of a high powered Voice of America relay station in northern Thailand. The transmitter planned will have a power of 400KW and the station is expected to go into operation by the end of this year.

ULAN BATOR VERIFIES

An airmail verification letter has been received, confirming our reception of Radio Ulan Bator, Mongolia, reported last May on 11850KC. The letter postcard and verification card gives details about the transmissions in English, which are carried twice each day, four days a week. Ulan Bator time is 8 hours ahead of GMT and the sessions are on the air at 5.30 a.m. and 10.20 p.m. Tuesday, Wednesday, Friday and Saturday. This is, in GMT, Monday, Tuesday, Thursday and Friday from 2130-2230, and repeats on Tuesday, Wednesday, Friday and Saturday at 1420-1520, on two frequencies, 11850 and 9540KC. The letter of verification is signed by Head of the Foreign Broadcasting Department of Radio Ulan Bator, Mongolia.

SWISS SCHEDULE

The Swiss Broadcasting Corporation's summer schedule, which remains in force till the first Sunday in March, includes some retimed transmissions, and a new service to China-Japan which should also give reasonable reception in the South Pacific. The following English transmissions from Berne are now on the air:

GMT		KC
0700-0800	Japan, China	9670, 11865.
0845-0945	Australia, New Zealand	11865, 15305, 17820, 21520.
1145-1245	United Kingdom	9665, 11865.
1330-1430	India, Pakistan	11865, 15305.
1330-1430	Africa	17845, 21520.
1515-1615	Near East	9655, 9665, 11865.
1515-1615	North America	11715.
1900-2000	Africa	9595, 11810.
1830-2000	Africa (Sunday)	15305.
0115-0215	Eastern United States	6080, 6120, 9535.
0415-0615	Western United States	6120.

The special program for the shortwave listener, "Swiss Short Wave Merry-go-round", is broadcast in the Saturday transmission, 30 minutes after the program commences. This includes news of the commercial shortwave bands on the first and third Saturdays and of the amateur bands on the second and fourth Saturdays each month. The monthly sunspot count is given in the first Saturday session, and a listing of letters received from listeners is a weekly feature of the session.

LISBON MOVES TO 7220KC

The new service of Radio Lisbon from Lisbon, Portugal, reported last issue as on 7130 and 9645KC 0730-0815GMT, continues to be well received. The 7130KC channel has been switched to 7220KC, which gives an even better signal, and this has been noted also by Bill Hawthorne of Warrnambool, Vic. The old 7130KC is still on the air, but is carrying a relay of the Emisora Nacional home program in Portuguese from Lisbon, which is also being transmitted on 6185KC. The transmission of the "Voice of the West" program from Lisbon is still poor on 9645KC due to sideband interference from the BBC London on 9640KC and other interference directly on the frequency.

ISRAEL ON 11905KC

We have been hearing what appears to be a new transmission for listeners in the Pacific area, from Radio Kol Israel in Jerusalem, when the station uses 11905KC from 0900 to 0945GMT. This transmission, in English, opens with a discussion program, then music, followed at 0930 by a news bulletin, and then another feature program which generally covers events of interest to listeners in the Pacific and Asian area. The signals are at fair level, but the solid signal of HCJB on 11915KC from Quito, Ecuador, does cause some minor sideband interference. The Israel program has been heard at 2015GMT in English for some years on 9009KC, but this is our first reception of the transmissions in the 25M band.

SIGNALS FROM SARAWAK

The recent extension of the schedule of Radio Sarawak at Kuching has improved reception of this station, as the new sign-off at 1600GMT finds its frequency of 4950KC free from interference. The old sign-off of 1430GMT was at a time when many signals from Indonesia and South Asia were in operation, making reception difficult. We have heard Radio Malaysia, Sarawak, with the news in English at 1530GMT at very good level, and the station closes at 1600GMT. Another Malaysian signal, of Radio Malaysia, Kuala Lumpur, uses 4985KC at the same time, and also gives very good signals in the Malay service. Sign-off is at 1630GMT.

PRAGUE'S NEW SERVICE

A transmission for listeners in Australia and New Zealand has been retimed by Radio Prague, Czechoslovakia, which is now on the air one hour earlier, 0700-0750GMT. The service is beamed to this area on four frequencies, 9505, 15230, 15285, and 21450KC. In addition, a transmission on 6005KC carries the broadcast for listeners in Europe. The transmission is well received on 9505KC and in the midsummer period the higher frequencies should also give good signal level on the three frequencies in use. The 21450KC signal is generally very good and free from the interference which is suffered by the two 19M band frequencies 15230 and 15285KC.

HAPPY STATION SCHEDULE

The Happy Station program broadcast by Radio Nederlands of Hilversum, Holland, with compere Edward Startz, is now broadcast as follows:

GMT		KC
0600-0720	New Zealand	11730
0730-0850	Australia	11970, 9525
1030-1150	Europe	9715, 5980
1430-1550	South Asia and Europe	17810, 15425
1600-1720	Africa	15160, 11730
1900-2020	North America	9590, 6085
2030-2150	Spain and Latin America	11730, 9560

These transmissions are on the air on Sundays only from Radio Nederlands.

WWVH ON 2500KC

A further frequency has been put into service by the National Bureau of Standards, over the transmitter WWVH at Maui, Hawaii. The station will now transmit its time and frequency services on 2500KC as well as on the present 5000, 10000 and 15000KC. The added transmission will be modulated with the same code as the other frequencies. This new service is intended to improve the time services accuracy of WWV broadcasts, and ensure good reception of these services in the Hawaiian Islands area.

The N.B.S. now operates WWV Greenvelt, Maryland, U.S.A.; WWVH Maui, Hawaii; and WWVL Ft. Collins, Colorado. These stations give world coverage on the 2500, 5000, 10000, 15000 and 20000KC frequencies and this permits the listener to obtain accurate calibration and time announcements. The stations give time announce-

SOUND PROJECTORS

Cinevox Prefect 16mm in good working order. 240v operated, complete with speaker and amplifier.

£47/10/-

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.

12/6 each. Post 1/-

REFLECTOR GUNSIGHT

Contains these lenses:
1 Lens 1in Focus, 1½in diam.
1 Lens 1 11/16in Focus, 1¼in diameter.
1 Air-spaced Lens, 1¼in diam.
1 Filter Lens, 1 Graticule.
1 Lampholder.

18/6 each

Post.: N.S.W., 3/-; Interstate, 4/-.

PMG TYPE TELEPHONES

Standard desk type with magneto calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line. Complete with 660ft wire.

£11/10/- pair

(2 TELEPHONE SETS)

3/- cartage to rail. Freight payable at nearest attended railway station.

AERIAL CAMERAS

F.24 Mark IV 2.9. Lens. stops 11, 8, 5.6, 4, 2.9.
With 3" x 8" F1 Dallmeyer Lenses complete with wooden case.

£19/10/-

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TRANSFORMERS

240 V to 6 or 12 V 2½ amps. 37/6. 5 amps. 49/6, 6 amps. £3/10/-, 8 amps. £4/15/-. Post N.S.W. 7/. Interstate 9/6.

AGC. Single phase, 1.75 Kva primary volts 100-200, 110-220, 120-240, 130-260, secondary, 2,200 1,700 at FL. PF equals 1.0. £17½

12 CREED TELEPRINTER

Tape printers model 47.R 240 Volts operated.

£17/10/0

TELEPHONE WIRE

21 gauge copper, plastic covered. Ideal telephone or bell wire, 1,320ft coil of twin (equal ½ mile), £3/10/ per coil.
Post., N.S.W. 7/; Interstate 12/.

3000 TYPE RELAYS

P.M.G. 200 Ohm — 1,500 Ohm Coils. 12/6 each.

2-WAY RADIO

NUMBER 22 (AUST.)

Untested without meter or leads, with power supply less relays, £7/10/. 5/ cartage to rail. Freight payable at nearest attended railway station.

A.W.A. 2-WAY RADIO

6 OR 12 VOLTS

70 to 80 megacycles, £15, or transmitter only £7/10/, receiver £7/10/. 240 volt power supplies for receivers only £7/10/. 5/ cartage to rail. Freight payable at nearest attended railway station.

POCKET 420 M/CS RECEIVERS

Contain 6 transistors and 3 diodes, pot cores, resistors, etc. Suit conversion to other frequency or for "Foxhunt Sniffers."
Complete in case 3in x 5in x 1in.

£5

AWA OSCILLOSCOPE

Calibrated with delay time base 5", 240 vac. perfect.

£97/10/-

P.M.G. TYPE PHONE JACKS, 2/ each.

NIFE CELLS

1.2 Volt fully charged, 4in x 3in x 1in 4 AH.

10/- each

Post N.S.W., 2/6; Interstate 3/6.
2.4v 6in x 2in x 2¼ 10 A.H. 25/.
1.2v 8 x 4 x 2in 25 A.H. 39/6.
Post, N.S.W., 7/; Interstate, 9/6:

Battery Chargers

240 to 6 or 12 Volts at 2.5 amps. Will charge either 6 volt or 12 volt batteries.

£4/19/6

Postage, N.S.W., 5/; I'state, 6/.

AUDIO AND ULTRASONIC OSCILLATOR

240 volt operated 12 switch selected frequencies in Audio range. 12 ultra-sonic switch selected frequencies, 19in rack mounting unit in Hammertone instrument case.

£12/10/-

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BRAND NEW

IN CARTONS

Special discount for quantity

6SN7GT	9/6	6AG5 . .	8/
89 . . .	10/	X61M . .	22/
12SA7 .	12/6	CV850 .	7/6
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41 . . .	12/6	832 . . .	50/
5U4G .	9/6	6F13 . .	7/6
77 . . .	10/	6AK5 . .	17/6
VR150-30	10/	6X4 . .	10/
5CP1 . .	39/6	6F8 . .	7/6
EF50 . .	3/6	6N7 . .	10/
6U7 . .	7/6	12SK7 .	8/
VI103 .	10/	VR1120 .	8/
VH120 .	7/6	VR118 .	7/6
1L4 . .	10/	VR65 . .	2/6
10 . . .	10/	6R7GT .	8/
5Y3 . .	12/6	VT4C .	7/6
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3" CV2184			22/6

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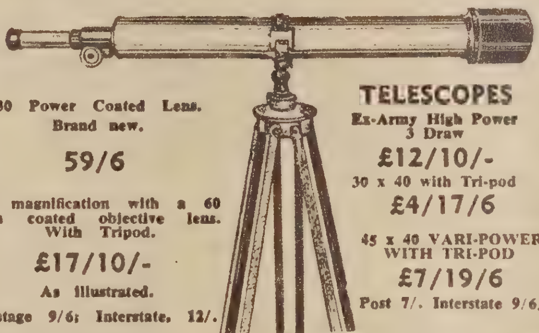

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nents every five minutes, Eastern Standard ime on WWV and Hawaiian Standard ime on WWVH.

ZYN32'S ENGLISH SIGN-OFF

Listening to the 11875KC outlet of the adio Sociedad Club de Bahia in Salvador, razil, recently, we were surprised to hear, hen the station was closing, an announcement in English identifying the station nd its frequencies. The station has been eard well at 11875KC to sign off at 330GMT, and following the usual Portuuese sign-off announcement the English nnouncement was given as follows: "This the Radio Club of Bahia in Salvador, razil. We are broadcasting over PRA4 40KC medium wave and ZYN31 15125 nd ZYN32 11875KC short wave." The tation then left the air with a good-night nelody. Power is 10KW on this frequency. he other channel, 15125KC, is not heard o well, due to interference on the outlet. he Brazilian station has the usual commerial program with music and announcenents to the sign-off at 0330GMT.

S.A.B.C. SCHEDULES

The new schedule announced by the outh African Broadcasting Corporation as been supplied by Evan Murray of Vellington, N.Z. The schedule gives the ddress for reports as P.O. Box 8006, ohannesburg.

Schedule is 0300-0400GMT 6150, 7270-C; 1000-1710GMT, 17805, 15222KC; 710-1845GMT, 11900, 15220KC; 1800-115GMT, 4975KC; 1845-2000GMT, 11900, 525KC; 2000-2115GMT, 727, 9525KC. On Sundays, the weekday transmission comnencing at 1000GMT on 17805 is not roadcast, but is replaced by 11900KC at 650GMT.

RED CROSS TESTS

The schedule of the test transmissions or 1966 has been announced by the International Red Cross in Geneva, which will arry out these tests over a transmitter oaned to them by the Swiss Broadcasting orporation in Berne, Switzerland.

The International Committee of the Red ross plans to test on 7210KC at 0600-700, 1130-1230, 1500-1600 and 2100-2200-MT, in French, German, Italian, English, panish and Arabic (10 minutes of each). nglish will be heard 30 minutes after the tart of each transmission. In 1966, the lates for tests are January 10, 12, 14; March 21, 23, 25; May 9, 11, 13; July 4, , 8; September 19, 21, 23; November 21, 3, and 25. Our thanks to Tom Chisnall, of Nelson, N.Z., for this information.

HAVANA ON 6000KC

The transmissions on 6000KC by Radio Havana, Cuba, includes a news program n Arabic at 0800GMT. This session is folowed at 0820 by station interval signal, uba's anthem and then a program of atin American music with Arabic anouncements. Signals are fair in this area, nd should also provide fair reception in Australia during the period to early March, 966, during which the transmission s scheduled to use the channel.

One of the unusual features about the se of 6000KC by Havana is that the requency is also used by the anti-Cuban tation Radio America, on Swan Island, off the Cuban coast, which is operated by United States interests. Radio America is everely jammed by Havana till it closes t 0700GMT. With Radio America off the ir, Havana then uses the frequency for an Arabic service to North Africa. As soon s the frequency is clear of the opposition ignal, Havana put it into use and hope hat listeners will tune to their program on 0000KC. The fact that the frequency is lmost continuously occupied by Cuba, even when not transmitting programs, shows o what extent some broadcasting authoriies will go to try to interest overseas isteners in their services, and at the same ime block home listeners from hearing ransmissions directed to their own ountries.

FLASHES FROM EVERYWHERE

MONTREAL, in the International Service of Radio Canada, has made some changes in its service, but the transmission to the South Pacific, is still on the air, from 0730-0830GMT using 5970 and 9625KC. The tentative schedule from March onwards also gives this time and frequency outlets to carry the service to Australia and New Zealand. The major changes in the Montreal trasmissions are in the European Service 1100-1214GMT, where 11720KC replaces 17820KC, also 15320, 11720 and 5970KC now carry this transmission. Another change is that the 1215-1315 English trasmission is now on 15320, 11720 and 5970KC. To Northern Canada, at 2200-2245, will be on 5970, as well as 11720 and 9625. The services to United States, and Latin American services are unchanged.

NORWAY is now using the 11M band for its transmission beginning 1100GMT, with the Oslo station using the frequency 25900KC from 1100-1230, 1300-1430 and 1500-1530GMT. This indicates that the station is confident such a high frequency will be received at some distance with the rapid rise in sunspot activity. It could also mean that other broadcasters will commence to use the 11M band, the highest frequency band allocated to international short wave broadcasting.

NOTES from readers should be sent to Arthur Cushen, 212 Earn Street, INVERCARGILL, N.Z. All times are in GMT; add eight hours for Perth, 10 hours for Sydney and 12 hours for Wellington time. All frequencies are in kilocycles.

DAKAR in Senegal is reported as now using 9675KC, and is on the air from 1730 to 1750GMT. According to a report from Europe, the program is in French, and signals in Europe are good.

LEBANON, Beirut, has a transmission to Africa in English, which is on the air in Arabic from 1830 to 1900, 1900-2000, and in French 2000-2030, on 11825KC. The English transmission to North America is still being received on 9670KC from 0230-0300GMT.

POLAND, over Radio Warsaw, is on the air for Africa in French and English, 1300-1330; in English and French 1230-1300, 1330-1400 on 7125, 11810, 15120KC. English 1900-1930 and French 1830-1900 on 7285, 11840KC. English 2200-2230 and French 2230-2300 on 6107, 7125, 7145, 7285 and 11840KC. The new frequency of 6107KC is replacing 6135KC for these transmissions, according to the Swiss DX Session.

PEKING'S transmission from China to Australia and New Zealand 0830-0830 GMT is on 11680 and 15080KC, moved from 15060KC. We note the 0930-1030 transmission is now on 15080 and 11680 as well as 15435, blocking BBC London, and on 15500KC.

QUITO station HCBJB in Quito, Equador, continues to make some frequency changes in order to get better channels. The latest frequency to be used is 11775KC, which is on the air at 2200. At the conclusion of a session in Portuguese, the station announced before closing down that transmissions in Japanese would continue on 15115 and 17895KC.

BASUTOLAND or the Lesotho Broadcasting Corporation, Maseru, will be on the air this month with two transmitters, one of 10KW for medium wave and one 5KW for short-wave broadcasting.

EGYPT is reported to be carrying out test transmissions to North America, according to Los Angeles listener August Balbi. The transmissions are on 9595KC and heard 0000-0100GMT. The station identifies in Arabic, English and French. The Cairo transmission in English best received in the Pacific area is on the air at 2130GMT, on 11915 and 9475KC.

ADDIS ABABA station ETLF is now on 11755KC in Arabic from 1700-1830GMT, with broadcasts from the Ethiopian capital. The Addis Ababa transmission in our afternoon has now been heard on 11875KC at 0430-0500GMT in transmission in Hausa.

INDIA. All India Radio station in Delhi uses the new channel of 9575KC, from 1330-1630GMT. The transmission, which has English 1500-1600, news at 1530 GMT, is carried from the home program of all India Radio.

HAITIAN stations at Cap Haitian have made some callsign changes, according to Dick Pollard of Golden Downs, NZ. The key station 4VEH shows that 4VWI is now changed to 4VEF, 4VEC is now 4VEJ, and they have ceased operation in the 13, 16, 19M bands. The station 4VSO on 2450KC with 250W was the station which Dick Pollard verified. 4VEJ is on 11835KC, 4VEH is still on 6120KC, and the same call is on 9770KC.

VENEZUELA has a new high-powered short-wave transmitter, which is affiliated with the Cadena Venesuela de Radiodifusion, with the station at Barquisimeto. This station "Radio Juventud" is broadcasting on 840KC MW, and 4900KC SW. The short-wave outlet has been reported from Europe, and the station address is P.O. Box 567, Baquisimeto, Venezuela, and the times of transmission are 1000-0400GMT.

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1—1009 Dual changer fitted with ADC 770 Cartridge and Diamond stylus.

1—Teak base for changer.

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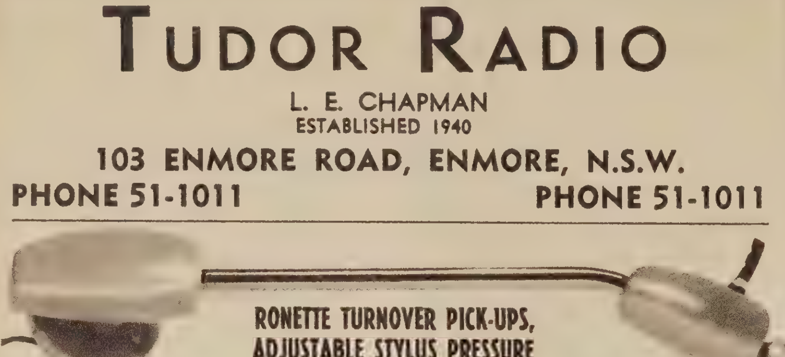

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All kit sets include speakers and every component including valves.
Pots 250K, **5/- each.**
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TU 13 watt per channel with TU 11 facilities **£16/-/-.**

TV TUNERS, 13 Channel, New .. .. .. **£7/10/**, post 7/6
Knobs, long shaft, push on **12/ doz.**
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25,000 to 3 ohm **15/**
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250 mixed Screws, self tappers, bolts, nuts, etc. .. **10/** bag, post 2/6
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Crystal Microphones, good quality, ideal tape recorders, etc. .. **£1/8/**
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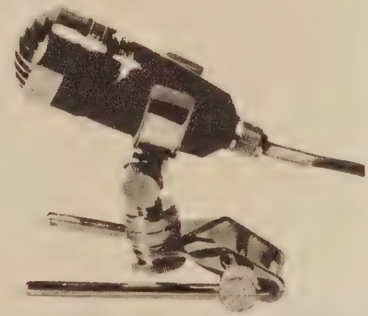

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MSP 12 inch twin cone 15 ohm **£3 15 0**
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Rola 5B 3 ohm **£1 0 0**
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8 x 4, 15 ohm **£1 15 0**
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6 x 4, 33 ohm **£1 5 0**
2 x ½, 15 ohm **£1**
5 x 3, 47 ohm **£1**
5 x 3, 27 ohm **£1**

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TV Transformers voltage doubler **£4**

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All types **£1/15/0** to **£10.**

BROADCAST BAND NEWS

SOUTH KOREA. The American For Korean Network, known to listeners AFKN, has made some frequency and lo tion changes in recent months. The static which operate a 24-hour-a-day service the United States servicemen South Korea, are frequently heard on broadcast band, early morning. Details the network, supplied on a verification ca with code name of the station shown (a when no code name, the location of relay station) are included in the det on the operations of the AFKN broadca Baynet 1200KC; Youasngni 580KC; Cor 1360KC; Gypsy 1400KC; Homestea 780KC; Kilroy 580KC; Mercury 1440K Vagabond 560KC; Vagabond (Sec 1440KC; Chunchon relay 1040KC; Kw dea-ri 1160KC; Kwang-ju 1150KC; Poha 1510KC; Taejon 1480 and 1040KC; Wo 1440KC.

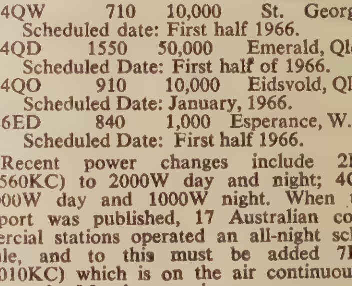
AUSTRALIA. The Australian Broadca ing Control Board's annual report sta that the Board has approved: the est lishment in January, 1965, of a new Natio ABC station for Cooma, N.S.W., to oper on 1570KC with 50W; the establishment June, 1965, of new medium-wave stati for the ABC at Broome (50W), Der (2000W) and Port Headland (2000W). T report says the new stations should prov a reliable service for some 6,000 peop It has also been recommended that 2000W station should be established in Bunbury-Busselton area of Western Aust lia. These proposals have been approv but it will be some time before the static commence operation.

The possible opening dates of other n stations, assigned frequencies and callsig are as follows:

Call	KC	Power	Location
4QW	710	10,000	St. Georg
Scheduled date: First half 1966.			
4QD	1550	50,000	Emerald, Ql
Scheduled Date: First half of 1966.			
4QO	910	10,000	Eidsvold, Ql
Scheduled Date: January, 1966.			
6ED	840	1,000	Esperance, W.
Scheduled Date: First half 1966.			

Recent power changes include 2I (1560KC) to 2000W day and night; 4C 2000W day and 1000W night. When report was published, 17 Australian co mercial stations operated an all-night sc dule, and to this must be added 7I (1010KC) which is on the air continuou except for Monday morning.

Directional aerial systems have be installed at 2UH, 7ZR, 2AD, 2KM, 2M 3CS, 3UL, 4BH, 4NA, 4UA and 7SD, a will also be used for 4QB, 7NT, as w as for the new National station 4QW 710KC, which will share the channel w 7NT. These aerials have lessened the pro lems of establishing 2UH, 4QW and 4N and have eliminated common channel int ference affecting stations 2AD, 2MG, 2K 3CS, 3UL and 5AU. Allocation of the t channels 880 and 980KC, which have be made vacant by the shift of 3UL and 2K to 530KC, is under consideration.



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ANSWERS TO CORRESPONDENTS

When writing to us:—

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- **Write the above information clearly or, for preference, print it in block letters. Your co-operation will facilitate delivery of replies by mail, where such are called for.**

TV AERIAL

H.D. (Strathfield, N.S.W.) writes expressing his satisfaction with a TV antenna constructed from one of our early designs. Even though it is a simplified version of our original design —driven element, phasing bar, and low band reflector—it is receiving all stations well, including Channel 10, which was not envisaged when the aerial was designed. However, slight ghosting is noticeable on some channels.

Vhile you do not mention which channel s suffering from the small amount of hosting, we assume it would be the high requency channels. The antenna as contructed has no reflector elements for the igh frequency channels and is therefore usceptible to reflections on these channels. f alterations or additions are planned we vould suggest that the next step would be o add the high band reflector assembly.

METAL LOCATOR

. R. McG. (Lindenow South, Vic.) writes requesting circuits for a transistorised metal location device.

Ve assume from your letter that you are nterested in mineral or buried metal locaion. If this is correct we are unable to upply a suitable circuit. However, if you re interested in tracing buried pipes or viring of which one end is acessible for onnection to an oscillator source we are ble to supply a suitable circuit. Details of his unit were published in the September 965 edition.

UHF STEREO ETC.

. W. (Wyangala Dam, N.S.W.) expresses interest in a circuit which would be suitable for UHF stereo transmissions and have a secondary function of providing high fidelity reproduction of TV sound signals.

Vhile it is natural enough to speculate at vhat might or might not be possible, you re way ahead of possible events. The icences granted for FM stations in Sydney nd Melbourne are on a purely experinental basis, with no commitments about nono or stereo content, technical method, rogram content, schedule, etc. There is no uarantee that these experimental licences vill lead to the issuing of other such icences or the setting up of any kind of ermanent service. No less important to our ideas is the fact that the transmitters n question operate on the UHF section f the spectrum and that their coverage vill be severely restricted by modest power nd aerial installations. As a rough guide, hey may serve with sound an area less han the present high-band TV stations nanage to serve with picture. In your ocation, your chance of hearing either the ydney or Melbourne stations would be ust about nil. If you are in the service rea of a VHF TV station and you onsider reception of wide-range sound vorthwhile, it should not be too difficult o tap off a mono sound signal from a egular TV set to feed your hi-fi system.

The kind of tuner you would require to resolve FM-stereo from a UHF transmitter —even assuming such a service became available—would be so different that we doubt the wisdom of trying to evolve a double-purpose unit. It would probably be a lot simpler and no more costly to meet this requirement with a special-purpose tuner quite separate from the TV system. If and when it becomes worthwhile to say more about this matter, you can rest assured that we will do so.

CREEPING TRAP

J.H. (South Yarra, Vic.) submits details of an usual TV fault. After running for 30 or 40 minutes the TV receiver would gradually lose brightness and finally go completely dark. After switching the set off for a while the picture was automatically restored. Our correspondent states that investigation showed that the ion trap magnet was gradually moving out of adjustment by creeping along the neck of the tube, as the result of thermal expansion, and creeping back again when the tube cooled. The fault was cured by placing a piece of emery paper under the magnet to give it a better grip on the glass.

Well, we certainly agree that this sounds like a most unusual fault and will pass your letter along to the serviceman for his consideration. However, without being able to observe the symptoms first hand, we are at a loss to understand why this fault should occur. In particular we find it hard to explain how the magnet could move back along the neck of the tube to the precise position it occupied originally. Perhaps other readers would like to comment.

NEW ZEALAND READERS

When writing to us, make sure that your return address includes the words "New Zealand." In many cases the names of New Zealand towns are repeated in Australia, often in more than one State. As a result, there have been several recent cases where incomplete New Zealand addresses have caused mail to be despatched to a number of Australian towns before being returned to us marked "Address Unknown."

FISH CALLER

D.J.K. (Belmont, N.S.W.) requests information regarding the construction of a transistorised Fish Caller.

So far we have not published any information on this particular subject. We understand that some time ago the C.S.I.R.O. Fisheries and Oceanography Division intended to conduct a scientific investigation into this subject, but we are not certain whether this research has yet been carried out. Until more information is available on this subject, either from such reliable sources as above or personal experimentation, we are unable to give any advice on the construction of fish calling equipment. In the meantime, anyone interested may care to contact the above C.S.I.R.O division.

MAGNETIC SOUND TRACK

A.J. (Epsom, via Bendigo, Vic.) has a 16mm sound projector, with optical sound system. He would like to add an extra facility so that films with magnetic sound track may be projected.

This modification may be possible, but each type of projector would have to be considered individually. In such a modification, it may be necessary to change the routing of the film, to accommodate the magnetic head. A different pre-amplifier may also be necessary so that it would present electrical as well as mechanical problems. We have not presented any information on this subject in the past and regret that we are unable to be of assistance on this occasion.

TRANSISTOR RADIOGRAMS

G.J. (Longueville, N.S.W.) says he would like to see us produce a solid-state radiogram with about 8 watts per channel and presented in considerable detail, with wiring diagrams and "the works."

Technically, the idea is entirely feasible, although not without some second-order problems. The main difficulty has been that in the class intermediate between very simple playing equipment and the expensive hi-fi gear, valve-type circuits have been simpler and cheaper for a given order of performance than the solid state equivalent. The position has been changing gradually, however, and with it the incentive to produce something along the lines you request.

"ELECTRONICS Australia" INFORMATION SERVICE

TO assist readers, "ELECTRONICS Australia" conducts a technical information service. Conditions governing this service are set out below:—

(1) Address letters to: Assistant Editor, "ELECTRONICS Australia," Box 2728, G.P.O., Sydney.

(2) Requests for copies of circuits or technical information requiring a postal reply must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(3) For the 2/ fee, we will supply circuit data, as available, from our files. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuits will be answered more speedily if they are not complicated by questions requiring the attention of technical personnel Where articles are not on file we can usually provide a photostat copy at 2/ PER PAGE.

(4) The information service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits. Please note that the inclusion of an extra fee does NOT entitle correspondents to special considerations.

(5) The editor reserves the right to return fees or to limit the scope of an individual reply when it is felt that a partial answer will be better than none at all.

(6) In addition to the above service, chassis blueprints are available for most of our projects showing the position of holes and cutouts for metal-working, but containing no details of wiring. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in. x 8in. glossy print, postage 9d extra.

(7) "ELECTRONICS Australia" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications should be obtained from advertisers.

(8) Technical queries are not answered by telephone.

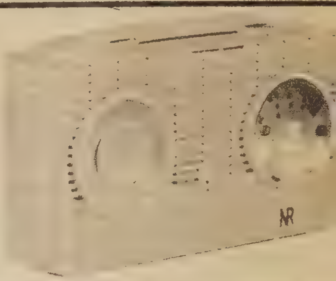
(9) We have no file of circuits for commercial radio or TV sets, etc.

Special Purchase of Manufacturer's stock of Transistors and Transistor Components enables us to offer Transistors and Kit-sets at a fraction of original cost.

Complete KIT for TRANSISTOR 6 PORTABLE £10/19/6

The complete kit of parts for the transistor six includes six transistors, printed circuit board, coil kit, 4in speaker, Ferguson driver and output transformers, heavy duty battery and all necessary parts to complete the set with full instructions. **Set is housed in attractive plastic case as illustrated.**

Dials available for all States. Post and Packing extra. N.S.W., 10/; Interstate, 13/.



NEW ENGLISH MAZDA TRANSISTORS

TYPE	EQUIVALENT		
XA101	OC45	R.F. Transistor	5/6 ea.
XA102	OC44	Osc. Transistor	7/6 ea.
XB103	OC75	AUDIO general purpose	7/6 ea.
MTC71	OC71	General Purpose	

Ducon type SFT 123 equiv. OC74 .. .. 7/6 ea.
Available in matched pairs at .. .. 15/ pair
AUDIO OUTPUT
Post and packing on transistors 1/6 any quantity.

A.W.A. 23" E.H.T. transformers and 23" 110 deg. deflection yokes. New manufacturers stock E.H.T. units 50/-. Deflection yokes 50/-. Post free.

NEW VALVES AT BARGAIN PRICES

1A7GT	9/6
1C7G	3/
1D8GT	9/6
1K5G	4/
1K7G	4/
1M5G	4/
1P5G	2/6
1Q5G	2/6
1T4	4/6
3Q4	7/6
EF50	4/6
3S4	10/
5Y3GT	12/6
5V4G	10/
6B8	10/
6C8G	5
6F6	10/
6H6	3/6
6J5	7/6
6K7G	4/6
6K8G	6/9
6Q7G equiv. 6B6G	10/
6SA7GT	9/6
6SH7	5/6
6SJ7	9/6
6SN7GT	9/6
6SS7 equiv. 6SK7	8/6
6U7G	4/6
6X5GT	7/6
7C7	3/6
12AU7	10/
12AT7	10/
1L56	9/6
12A6	5/
12SK7	5/
12SK8	5/
12SH7	5/
866	15/
954	2/6
955	2/6
7193	2/6
EK32	6/9
EL33	10/

Please add postage on all valves.

NEW 4-SPEED STEREO & MONO PLAYERS

AT LESS THAN HALF PRICE

PHILIPS 4-SPEED 6V BATTERY PLAYER

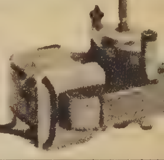
MONO	£4/17/6
STEREO	£5/17/6

Post and Packing, N.S.W., 7/6.
Post & Packing Interstate 12/6 extra

NEW 240V. ELECTRIC MOTORS

3300 R.P.M. can be supplied with or without 4-speed reduction mechanism. Size 3¼" x 2¾ x 3½, including spindle.

27/6 Each



NEW PORTABLE RECORD PLAYER CASES TO SUIT THE ABOVE TURNTABLE

Attractive two-tone cabinet with plastic trim.
Supplied with 5in x 7in speaker in felt-lined enclosure
Space for amplifier and batteries or power supply.

Dimensions 15in x 13in x 7in.
Post and Packing: N.S.W., 9/; Interstate, 12/.

£5/15/-

NEW MULTIMETER — 57/6

POST EXTRA
METER 0-1MA 1,000 OHMS PER VOLT
A.C. RANGES D.C. RANGES CURRENT
SUPPLIED COMPLETE WITH TEST LEAD
RANGE 0-100,000 OHMS

0—10v	0—100v	0—500v	0—500MA
0—50v	0—10v	0—1000v	
0—250v	0—50v	0—1MA	
0—500v	0—250v	0—100MA	

EXTENSION SPEAKERS

New 9 x 6 speakers in case with volume control, 75/. Post: Interstate, 5/6; N.S.W., 4/.

NEW POWER TRANSFORMERS

60mA prim.: 240v with 230v tapping Sec. 285 x 285 with 6.3v filament winding. 60mA, 25/. Plus postage: N.S.W., 3/6; Interstate, 5/3.

Prim.: 240v, Sec. 385 x 385 at 80mA, fil. 6.3 and 5v, 27/6. Post.: N.S.W., 4/; Interstate, 7/6.

60mA H.T. Chokes, 7/6. Post.: 2/.

SHOP-SOILED 60 M.A. TRANSFORMER

285 x 285
One 6.3 volt winding 15/- each plus post. N.S.W. 5/-, Interstate 6/-.

P.M.G. PRESS TO TALK HAND SETS, 25/- each.

Post and pack 3/-.

NEW AMERICAN RECORDING TAPE

At ½ List Price

5¾in 900ft Acetate	£1/2/6
7in spool 1800ft Mylar	£2/2/6
5¾in spool 1100ft Acetate	£1/5/0
5in 800ft Mylar	£1/5/0

Post and packing, 2/6 extra.

NEW MIDGET POWER TRANS.

40mA prim., 250v. Sec 225 x 225 with 6.3v Fil. Winding.

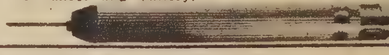
27/6 Postage: N.S.W., 2/6; Interstate, 4/6.

30mA 240v Prim. 150 x 150v. Sec. with 6.3v Fil. Winding.

27/6 Postage: N.S.W., 2/6; Interstate, 3/6.

TRANSISTORISED SIGNAL INJECTOR, 55/-

A MUST FOR QUICK TROUBLE SHOOTING
Using TWO Transistors, complete with instruction sheet and battery. Post free



NEW PER-MAG SPEAKERS by Australia's leading Manufacturer

6in Per Mag	35/
3½in Per Mag	22/6
5in Per Mag	27/6
5in x 7in Per Mag	32/6
Post and Pack, 3/6 N.S.W.; Inter.	4/6
6in x 9in Per Mag	37/6
3½in Per Mag Tweeter with Cross Over Condenser	20/
6in x 9in Per Mag Hvy. dty. 15 ohm	42/
8in per Mag	37/
10in per Mag	47/
12in per Mag	67/
12in per Mag 20 watt	135/

Post and Pack, 5/ N.S.W.; 7/6 Interstate.
12in Per Mag .. .. 67/6, Post and Packing 7/6 N.S.W., 10/ Interstate.
Speaker Transformers for above 6T, 5T or 7T 10/.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

SPECIAL PURCHASE OF FACTORY STOCK

RESISTORS, CONDENSERS AND POTENTIOMETERS

We have purchased the resistor and condenser stock of manufacturers including S.T.C. and Stromberg-Carlson who have ceased the maufacture of television and radio receivers and can offer same at less than 25 per cent of list price.

The resistors are mainly I.R.C. and Morganite in values from 200 ohm. to 5 meg in ½, 1 and 2 watt ratings and include some wire wound resistors. List price, £4/10/ per 100. **Our Price, 20/ per 100.** Post and packing, 2/6 extra.

The condensers are in most popular makes and include mica, ceramic, paper and electrolytic in standard values. List price, £5/10/ per 100. **Our Price, 20/- per 100.** Post and packing, 3/6 extra.

The potentiometers are all current types and include switch pots, dual concentric and THB pots. List price, £6 per dozen. **Our Price, 25/ per dozen.** Post and packing, 2/6 extra.

FREE For a limited period with each lot of resistors, condensers or potentiometers purchased we will supply free: One New Valve Type 6U7G or IT4 as advertised on this page.

New English Miniature 11 x 1 Switches

These new miniature eleven-position single-bank switches are 1" diam. with ¼" spindle, they have silver-plated contacts and high quality insulation suitable for H.F. use.

4/9 each. Post and packing 1/6.

NEW GARRARD RECORD CHANGERS

These New English Garrard Changers with High Fidelity Crystal Pick-ups and Sapphire Styli have just been superseded. We are selling same at LESS THAN HALF PRICE. Available in STEREO at £12/15/. POST AND PACKING EXTRA N.S.W., 15/; QLD., VIC., TAS., 22/6; W.A., S.A., 30/.

HIGH-SPEED 240V. AC/DC MOTORS

These 240 v. a.c. or d.c. motors are 1/8 H.P. with a speed of 7,000 R.P.M. and are ideal for small drills, grinders, etc. Dimensions, 5½in x 3½in, with 5/16in spindle 37/6

Post, N.S.W., 5/; Interstate, 8/6.

NEW 4-SPEED STEREO PLAYER F.O.R. £8/15/0

NEW STEREO CHANGER. 4-SPEED F.O.R. £10/15/0

SLIDER-SWITCHES
10 pole 2-way silver plated contacts 3/9

TYGAN AND SARLON SPEAKER GRILLE FABRIC

54in wide. List price 60/- per yard. To clear at 40/- per yard.

Postage and packing N.S.W., 3/6; Interstate, 4/6.

LEADER SIGNAL GENERATOR LSG11

240V A.C. operated, 6 band 120KC to 390 Megs Provision for crystal. Post N.S.W. 7/6; Interstate 12/6. £15

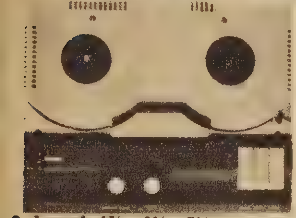
BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp., 37/6. Post, N.S.W., 2/; Interstate, 2/. Transformer for above rectifier tapped for 6 or 12 volt, with circuit for charger, 47/6. Post, N.S.W., 7/6; Interstate, 10/.
As above, 6 or 12 v., at 2 amp., 27/6. Post, N.S.W., 3/6; Interstate, 4/6. Transformer for above, 37/6. Post, N.S.W., 3/6; Interstate, 4/6.

NEW 240V. A.C. MOTORS

These small motors, size 3in x 3in x 3½in, are 1-12 h.p. but are only suitable for intermittent use. **29/6. Post** N.S.W. 3/6; Interstate 5/.

THE NEW COLLARO 3-SPEED TAPE-DECKS 2 & 4 TRACK



The ideal deck for the home constructor, as amplifier and all controls can be mounted on deck.

● 3-speed 1⅞, 3¾, 7½. ● Pause control. ● Takes 7in spools. ● Simplified controls. 4 Track, £24; 2 Track £22. OSC Coils, 15/.

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital counter and will take 7in spools.
2 Track, £17/15/; 4 Track, £22/12/6.

NEW IMPORTED "NATIONAL" TRANSISTOR SIX PORTABLES

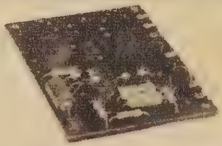
These small Portables, size 3½in x 2½in x 1½in have excellent tone and good sensitivity. Selling at less than wholesale price.

£12/17/6 (Post free)

Supplied with leather case and earphones.

A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

SUITABLE FOR USE WITH THE COLLARO OR B.S.R. TAPE DECKS



Using 3 silicon transistors as featured in October, Electronics Australia complete with kit of parts including transistors mono **£3/15/**, stereo **£6/10/**, 240 power supply for above **£3/10/**.

NEW 17 & 25 WATT P.A. AMPLIFIERS

25 WATT £26/17/6
17 WATT £21/17/6

Post Extra on 15 Watt N.S.W., 10/; Interstate, 15/. 25 Watt by Rail or Air. Too Heavy, for Post.

The 25 Watt Amplifier uses 5 valves plus 2 rectifiers including two EF86 low noise valves as microphone preamplifier and two EL34 valves Ferguson push-pull output.

All amplifiers are fitted with Ferguson output transformers with voice coil tappings of 2 to 15 ohms. The 25 watt amplifier can be supplied with line output transformer tapped from 100 to 600 ohms if required at 20/ extra.

Inputs provided for microphone, pick-up, and radio with mixing facilities and tone control.

The 15 watt is as above but using two 6BQ5 valves in push-pull output.

12in speaker for above (10 watt) 67/6

Crystal Microphones for amplifier 47/6

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

A. C. E. RADIO

AMPLIFICATION
COMMUNICATION
ELECTRONICS

★★★★★★★★★★★★★★★★★★★★★★ PHONE 51-3845

136 VICTORIA ROAD, MARRICKVILLE, SYDNEY,
AND 636 KING STREET, NEWTOWN—51-7008

EVENINGS and WEEKENDS: "KALUA," Hilma Street, Collaroy Plateau, XW5956
DULWICH HILL, EARLWOOD, BUS STOPS AT DOOR, STOP No. 42

NEW

HOME LIGHT BATTERY

CLYDE OR DUNLOP
19 Plate. 150 Amp.
Dry Charged. Cells.

£1/12/6 ea

A.C. D.C. MOTORS

32V and 110V
High Speed. Series Wound.
1 8 h.p. motors.

£1/17/6

Post. N.S.W. 7 6, Interstate 12 6.

NEW VALVES

1A3	7 6	12SK7	5 0
1A5	7 6	12SL7	12 6
1C5	7 6	47	12 6
1C6	12 6	76	7 6
1C7	5 0	84 624	12 6
1D5	5 7	304TH	1 10 0
1F5	10 0	723A	3 0 0
1G4	7 6	803	3 0 0
1H5	7 6	807	1 0 0
1H4	7 6	809	17 6
1J6	12 6	813	3 10 0
1K7	5 0	829B and	
1L4	5 0	Socket	2 17 6
1M5	5 0	843	1 10 0
1N5	7 6	866A	15 0
1Q5	5 0	954	5 0
1T4	10 0	1603	5 0
2A3	1 0 0	1616	7 6
2C26	7 6	1619	1 0 0
2X2-879	5 0	1629	5 0
3A4	12 6	1050	1 0 0
3B7	10 0	9006	5 0
3D6	10 0	AV11	2 6
5U4	10 0	CA19	5 5 0
5X4	10 0	CK1013	15 0
5Y4	10 0	CV63	7 6
5Z4	10 0	CV66	7 6
6AC7	7 6	CV1102	7 6
6AG5	9 6	CV1133	7 6
6AG7	10 0	CV1136	7 6
6AJ5	5 0	EBC33	7 6
6AK5	10 0	EC70	4 0
6AL5	7 6	ECH33	15 0
6AM5	7 6	EF36	7 6
6AM6	7 6	EF37	7 6
6AN5	12 6	EF39	7 6
6AR6	12 6	EF72	4 0
6AN7	1 0 0	EF73	4 0
6AS7	1 0 0	EK32	15 0
6B6	7 6	EL91	10 0
6B8	7 6	KTW62/	
6BF6	10 0	6U7	7 6
6BL8	7 6	RL27	15 0
6BM8	7 6	RK34	7 6
6BY7	7 6	RK75	10 0
6C8	7 6	RK84A	3 0 0
6F6	10 0	VR65	5 0
6G6	7 6	VR75 30	15 0
6J5	9 6	VR105 30	15 0
6J6	7 6	VR150 30	15 0
6J6	10 0	VT502	12 6
6J7G	7 6	32	10 0
6K6	7 6	42	10 0
6K7	5 0	45	10 0
6N7	7 6	37	10 0
6SA7			
Metal	7 6	49	10 0
6SC7	10 0	53	10 0
6SF7	10 0	59	12 6
6SG7	10 0	63	10 0
6SH7	4 0	89	10 0
6SJ7	9 6	77	10 0
6SK7	12 6	2V3	7 6
6SN7	7 6	OZ4	7 6
6SS7	12 6	CL4	12 6
6X5	7 6	EM1	12 6
7C5	5 0	EL32	12 6
7N7	7 6	TZ40	10 0
7W7	5 0	6AB7	7 6
12A6	5 0	6A3	12 6
12AT7	10 0	6C6	12 6
12BE6	10 0	6F7	12 6
12BH7	7 6	6SC7	7 6
12C8	12 6	7A6	7 6
12SJ7	12 6	9006	5 0

GENEMOTORS

Input	Output			
12v	600v	300mA	New	£5 10 0
12v	500v	350mA		£8 10 0
12v	1200v	200mA		£6 10 0
24v	250v	100mA	New	£2 0 0
24v	540v	200mA	New	£2 0 0
24v	300v	250mA	New	£2 15 0
12v	275v	110mA		£3 15 0

CHASSIS PUNCHES

SIZES ⅝", ¾", ⅞", 1".
1⅛" with tapered
Reamer and Carry Box.

£2/17/6

Post 5 . Interstate 10/.

NEW POWER TRANSFORMERS

1960 5in CRO	5 17 6
325 x 325 150MA	4 15 0
285 x 285 300 MA	7 7 0
800V and 270V 300MA	7 10 0
240V-110V 1.3KVA Auto	10 10 0
150 x 150V 30 MA	1 7 6
225 x 225V 40 MA	1 10 0
124V Doubler 300MA	3 7 6
130V Doubler 400 MA	3 17 6
145V Doubler 450 MA	4 17 6
150V Doubler 500 MA	5 7 6
220V Doubler 600 MA	7 7 0
310 x 310 170 MA	2 9 6

3" SELSYN MOTORS—TRANSMITTERS

50 V AC — 50 cps.

£2/17/6 each

Post 7 6; Interstate 10/.

RELAYS

6V, 3-pole Miniature	15 0
12 volts. DPDT, 5 amp	£1 0 0
12 volts DPDT	12 6
100pf TX var. condensers	10 0
Hi-speed Polarised relay	£2 10 0

PMG TYPE 3000

2000 ohms 12 6.
1000 ohms 12 6.

Lapel Crystal Mikes	12 6
Crystal Mikes with switch	15 0
Telephone Pick-up Units	12 6
Contact Pick-up Units	15 0
100UA Stereo Bal Meters	£1 15 0

OIL FILLED CONDENSERS

.5mfd 600V	3 6
2mfd 600V	6 6
1mfd 600V	6 6
4mfd 600V	6 6
4mfd 2.5K	£1 10 0
1mfd 3000V	17 6
.5mfd 5K, .1 5K, .1 3K AC .25 4K, .5 2½K ea.	15 0
4 mfd 3000	1 15 0
2 mfd 3000	1 5 0
1 mfd 3000	1 0 0
1.25 mfd. 6000v.	2 5 0
mfd 4000v.	1 10 0
2 mfd. 2000v.	15 0
4 mfd. 1500v.	15 0
1 mfd. 1500v.	10 0
8 mfd. 600v.	10 0
1 mfd. 1000v.	10 0

PYE REPORTER

2-way Vehicle Band Transceivers.
Ex Taxi Cabs.
12 volt, 70 meg. Complete with valves and speaker.

£16/17/6

NEW C.R.O. TUBES

3API-906 3in	£1 7 6
CV112 5in	£1 0 0
VCR97 6in	£1 17 6
ACR10 VCR139A 3in	£1 10 0
CV1522 1¾in	£1 2 6

6" INDICATOR UNITS

TYPE 1A
Suitable for C.R.O. conversion.
Circuit supplied.

Price £10/7/6

NEW 3-GANG CONDENSERS

300 PF + 200 PF + 60 PF

7/6

NEW HEADPHONES

5 Ohm	£1 2 6
2000 Ohm	1 2 6
4000 Ohm	1 5 0
American Lightweight	12 6
Australian DLR	12 6
Dynamig Earpieces, pr.	4 6

Post., 2/6 pr.

100 NEW ASSORTED RESISTORS

Mainly I.R.C., ½, 1.2 Watt.
04 Values. ½ ohm. to 10 megs.

15/-, Post 2/6

100 new assorted Condensers.
Paper, Mica, Ceramic Metalcap.
25 Values.

£1/-/- Post., 2/6.

WANTED

Communications Receivers. Test equipment. P.A. Gear. Large or small surplus stock. Best prices. Call, write or phone, any time.

TRANSISTORS

American Units.

MT-71-OC71	7 6
2N 174	2 10 0
2N 442	2 5 0
2N 441	2 0 0

High-powered units for 75-watt audio, 200-watt power units or transistor ignition.

T.B.Y. TRANSCEIVERS

20 to 80 Megs. Battery Operated.
4 Band units. Variable tuning.

£14/17/6

Complete with aerial. Headphones, microphone, junction box, plugs and cables.

£19/17/6

NEW G.M.F.

1/8 H.P. 240V-A.C. Motors
2 speed. Reversable.
Capacitor Start.
Double ended drive.
Ball bearings.

£2/15/-

NEW METERS

Square. Clear Plastic.

2¼in 50 UA	£2 7 6
3⅜in 50 UA	£2 17 6
2¼in V.U. Meters	£2 7 6
3⅜in I.M.A.	£2 7 6
2¼in 500V. A.C.	£2 2 6
2¼in 500V. D.C.	£1 15 0
3⅜in 500V. A.C.	£2 17 6
3⅜in 500V. D.C.	£2 10 0

Post. N.S.W., 2/6. Interstate, 4/.

INTER COM TELEPHONES

15 Line Connections.

£3/10/0 each

PILLOW PHONES

Low Imp. VC Matchings.
Ideal Hospitals, etc.

17/6 each

COMMUNICATIONS RECEIVERS

B.28—CR100

Current Navy Receiver
6 Band .40 K.C. to 32 Meg.
Variable Selectivity. 2 R.F.
2 I.F. Stages. Crystal Gate Ban
Spread. New condition. Air-testec
Realigned 240V A.C. operation.

£65/-/-

AR7 RECEIVERS

Air-tested, realigned. Perfect orde

£57/10/-

MECHANICAL FILTER

For SSB Receivers.
455 KC. Balanced or unbalance
as required.

£16/17/6 Post 5/

3BZ RECEIVERS

AIR TESTED. PERFECT ORDE
6v. Operation. 6 Band.
200 K.C. to 30 Megs.
Ideal communications Receiver
mobile and small ships' use.

£27/10/-

3BZ TRANSMITTER

12V. Operation. 15 Watt O.P
2 to 9 Megs.
Air tested. Perfect order.
Suit small ships, Bush Fire Brigade
Island Services.

£27/10/0

522 TRANSCEIVERS

Complete With Valves.
100 to 156 Megs.

£12/17/6

522 TRANSMITTERS

Complete With Valves.

£6/15/0

522 RECEIVERS

Complete With Valves.

£5/15/0

NEW ROTARY CONVERTERS

160 watt, 50 Cycle.
24v to 32v input.
Output can be supplied for 50-110 or 240v as required.
Suit radiograms, TV, Tape Recorders, Fluorescent Lights.

£19/17/6

450 Watt, as above.

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TECHNICAL BOOKS AND PUBLICATIONS

'RINTED AND INTEGRATED CIRCUITRY — Materials and Processes. By T. D. Schlabach and D. D. Rider. Cloth bound, 6in x 9in, 420pp., with many diagrams. Published by McGraw-Hill Book Co., New York. Price in Australia 142/ (14.20 dollars).

In recent years the growth of printed viring-circuitry and integrated circuitry echnology has undergone marked acceleraion, particularly in the fields of data proessing and instrumentation. New techiques and materials are being evolved to nake their appearance with ever increasng frequency.

As with most new techniques the equipnent designer is apt to encounter problems n the process of assimilating them into his onceptual and operational repertoire. Not he least of these will be the problem of vading through vast numbers of research eports, application notes and product handouts; but a major problem will no doubt rise from the fact that the new technolgies cut across so many of the established lisciplines — electronics, mechanics, graphic rts, chemistry, metallurgy, ceramics, ohysics, even statistics.

The authors of the volume under review attempted to make it at least a partial answer to this problem by collecting together as much as possible of the pertinent literature in the various disciplines concerned. For this task they were well fitted, both being senior staff members of Bell Telephone Laboratories, Inc.

The book is organised into four main sections. The first section discusses the mechanical, physical, chemical and electrical properties of organic and ceramic substrate materials; the second section, vital processes such as drafting, related graphic processes, board fabrication and protection; the third section, design procedures, criteria, standards and packaging (also repairs); and the fourth section deals with integrated circuitry. The book ends with a series of detailed appendices giving engineering data on base materials, embedding materials, test methods and specifications.

The style throughout is terse but lucid. The material is arranged in a logical fashion, and many diagrams and data tables are used for illustration. Each chapter ends with a comprehensive list of references. In all, a well thought-out and executed volume and one which deserves a place on the reference shelf of all contemporary designers.

Our copy came direct from the publisher, but we understand that copies are available at all major book suppliers. (J.R.).

* * *

RELATIVITY AND COMMON SENSE, by Professor Hermann Bondi. Soft cover, 178 pages, 7¼ x 4½ inches. Published by Heinemann Educational Books Ltd., London. Available from booksellers, price 8/6d.

This is a very brief account of relativity and, as such, can be regarded as only a curtain-raiser to a more detailed study. Since the book is another in the "Science Study Series" intended for young readers, this is no doubt all the author intended. For those who want to know something about the theory of relativity without getting too involved in the mathematics, this book will be interesting reading.

Einstein's proof of the relativity theory is, of course, based on advanced mathematics; but here the author is concerned only with a discussion of the theory, not with the proof, so a limited knowledge of mathematics will suffice to carry the reader through. If you have a knowledge of algebra and trigonometry to about sixth-form High school standard, you will probably not have any trouble following Professor Bondi's explanation. To help the discussion along, Professor Bondi uses a number of analogues; as is usual with analogues, these are only partly successful, but they certainly do help one to understand certain basic points.

The first chapters of the book are concerned with certain basic physical facts, the implications of which the reader must understand before venturing into the deeper waters of relativity. The author then shows how the relativity theory is derived from the classical physics of Isaac Newton, before proceeding to a discussion of relativity proper. An interesting aspect of the book is that, whereas previous writers on the subject have tried to show that the concepts of relativity are opposed to the Newtonian physics, Professor Bondi sets out to show that the opposite is the case, and relativity is derived naturally from the physical laws discovered by Newton. This gives the lie to the famous couplets, which say (speaking from memory, E. and O.E.).

Confusion reigned, man knew not wrong from right,
God said "Let Newton be" and all was light;
'Twas not to last. The devil howling "Ho!"
Let Einstein be" restored the status quo.

(H.A.T.)

* * *

RECEIVING TUBE SPECIFICATIONS AND SUBSTITUTIONS. Soft covers, size 9in x 6in, 138 pages. Australian price 22/ plus post 1/.

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TRANSISTOR SELECT-A-SPEC. Soft covers, size 9in x 6in, 137 pages, Australian price 44/3 plus post 1/.

DIODE SELECT-A-SPEC. Soft covers, 9in x 6in, 137 pages, Australian price 32/9 plus post 1/.

All the above published by Techpress, Inc., Brownsburg, Ind., U.S.A., and available in Australia from McGill's Authorised Newsagency, 183-185 Elizabeth Street, Melbourne, C.1, Victoria.

These books contain in tabulated form the principal operating data found in the publications issued by valve and semiconductor manufacturers but they have a number of additional advantages.

The first book on the list, "Receiving Tube Specifications and Substitutions," contains specifications of over 2,000 valves, from both American and other sources. Valves are listed according to type number in the usual way, but are also listed in another section according to characteristics, i.e., diode, triode, etc. To enable the user to determine similar valve types, when a substitute is required for a particular type, there is a "Similar Types" listing. The outstanding merits of the book may therefore be summarised as comprehensiveness and convenience.

Similar virtues may be attributed to "Transistor Specifications and Substitution Handbook" which lists 5,000 transistor types, their specifications and over 16,000 substitutes. An improvement in this book compared with the valve book is that all this information is listed in the same tabulation, thus avoiding the need for page turning to look for related information. The operating data shows all six maximum operating values.

The two "Select-A-Spec" books are intended to help the user select suitable semiconductors for particular requirements. In addition to maximum DC operating values, and typical gain figures at certain parameters, the "Transistor" book lists the use

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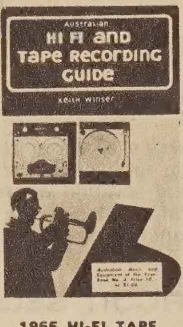

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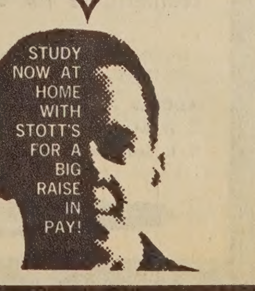
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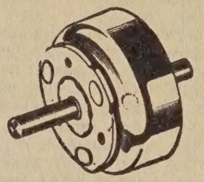

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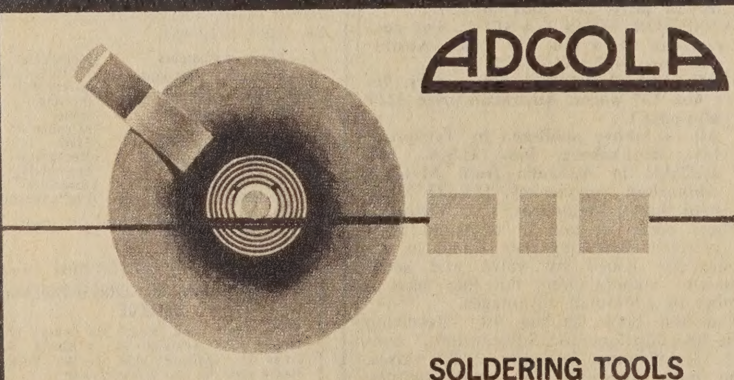

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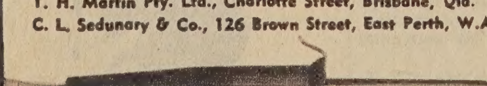

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only be fully realised by design engine
and others who need to refer constantly
the data they contain. (H.A.T.)

★ ★ ★

HEWLETT-PACKARD JOURNAL iss
dated October, 1965 (Vol. 17, No. 2) h
a lengthy article devoted to a descripti
of a new high precision AC-DC different
voltmeter/DC standard which measures A
voltages with high accuracy from 20cps
100KC by comparing the unknown volta
with a precision DC voltage. It al
measures DC voltages to 0.02 per cent a
supplies high resolution DC voltages. T
same issue describes a 200KC-500MC f
quency conversion unit for mixing, mod
lating, phase-detecting and level-controlli
(Australian agents for Hewlett-Packard a
Sample Electronics (Vic.) Pty. Ltd., 9-
Cremorne Street, Richmond, E.1, Victoria

RADIOTRONICS for November, 19
(Vol. 30, No. 11) contains a description
the AWV exhibit at the recent "Science
the Development of Australia" exhibitio
held in Sydney, August 14-19, and
account of the "Operation Multiflash" co
petition held in conjunction with the
hibition. Also in this issue is an article
titled "Life Beyond the Atmospher
(Published by Amalgamated Wireless Va
Co. Pty. Ltd., P.O. Box 63, Rydalme
N.S.W., subscription rate 20/ a year.)

ROLA CO. (AUSTRALIA) PTY. LT
Technical Bulletin No. 24, entitled "R
Alnico and Ferrite Magnet Loudspeak
Data," contains technical information on
current range of Rola loudspeakers, and
tails of the coding system used to ident
the various models, as well as recommend
tions on the specific applications for wh
each type is best suited. Available on
plication to Rola Special Products Pty. Lt
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mentioned a range of power transform
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filament transformers. There is also a n
range of transformers for use with lo
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R Transformers Pty. Ltd., P.O. Box 1
Box Hill, Vic.

**AMALGAMATED WIRELESS VAL
CO. PTY. LTD.** has prepared two n
educational aids which are available f
and post free to schools, radio clubs a
similar interested parties. They take t
form of 14in x 19in showcards printed
three colours on strong white board w
a 12in strut, to which are fastened co
ponent parts of the 6BE6 valve and 2N4
transistor. These are arranged to sh
assembly and steps in the manufacturi
process.

A.W.V. has also produced two n
technical brochures containing technical
formation about additions to the compan
range of semi-conductors. The products
scribed are the RCA-2N4012 silicon N-P
"overlay" transistor, designed to prov
high power as a frequency multiplier in
UHF, or L-band, frequency range,
military and industrial communicatio
equipment; and the RCA-3N98 and 3N
silicon insulated gate field-effect transisto
for low power applications up to 60M
(AWV Co. Ltd., 47 York Street, Sydn
or P.O. Box 2516, G.P.O., Sydney.)

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Advertisements in these columns cost only $0.50 (5/) per line. Each line contains the equivalent of five words each of nine letters. Minimum size of advertisement is two lines. PAYMENT MUST ACCOMPANY ALL ADVERTISEMENTS EXCEPT THOSE PLACED BY ACCREDITED AGENCIES. Your advertisement for the February issue must reach our office before January 5th. Address your advertisement to the Advertising Manager, ELECTRONICS Australia, Box 2728, G.P.O., Sydney.

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Inside Front Cover 8,
Amalgamated Wireless Valve Co. Pty. Ltd.
Amateur Astronomers Supply Co. .. ..
Amplion (A'sia) Pty. Ltd. 55,
Anodeon Sales Div. .. ..
Antiference Pty. Ltd. .. ..
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Broughton, Peter G. .. ..

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Classic Tape Recorders .. ..
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Department of Supply .. ..

Electronic Developments Pty. Ltd. .. ..
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General Accessories Pty. Ltd. .. .. ..
Goldring Eng. Pty. Ltd. 49,
G.R.D. Instruments Pty. Ltd. .. ..

Ham Radio Suppliers .. ..
H.B. Radio Products 45,
Heating Systems Pty. Ltd. .. .. ..
Homecrafts Pty. Ltd. .. ..

International Correspondence Schools ..
I.R.C. (Aust.) Pty. Ltd. 18,

Jacoby, Mitchell and Co. Pty. Ltd. ..
JH Reproducers Pty. Ltd. .. ..
Johnston, D. R. .. ..
Joylon Industries Pty. Ltd. .. ..

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Kodak (Australasia) Pty. Ltd. .. .. ..
Kuenzli, Ernest Pty. Ltd. .. ..

Lafayette Electronics .. ..
Leroya Industries Pty. Ltd. .. ..

Magnetic Sound Industries .. ..
Manufacturers Special Products
Pty. Ltd. 27, 68,
Master Electrics Pty. Ltd. .. ..
Mastersound Sales Pty. Ltd. .. .. ..
Motor Manual .. ..
Mullard—Australia Pty. Ltd. .. .. ..

National Radio Supplies 106,

Paton Electrical Pty. Ltd. .. ..
Pye Pty. Ltd. .. ..

Radio Despatch Service .. ..
Radio House Pty. Ltd. .. ..
RCA of Aust. Pty. Ltd. .. ..
R.C.S. Radio Pty. Ltd. .. ..
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Simon Gray Pty. Ltd. 16,
Stotts Tech. Correspondence College .. ..
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Tekni Cals .. ..
Top Management Services .. ..
Tudor Radio .. ..

United Radio Distributors Pty. Ltd. ..
University Graham Instruments Pty. Ltd.

Warburton Franki Ltd. 30,
Watkin Wynne Pty. Ltd. .. ..
William Willis and Co. Pty. Ltd. .. ..
Willis, S. E. Trading Co. .. ..
Wireless Inst. Aust. .. ..

Zephyr Products Pty. Ltd. 44,